

SOUTHEASTERN BIOLOGY



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ASB 68TH ANNUAL MEETING APRIL 18-21, 2007

The University of South Carolina
Columbia, South Carolina

ASB

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Abstracts of Papers and Posters
Presented at the Annual Meeting



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Lieber College, University of South Carolina, Columbia

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PURPOSE

The purpose of this association shall be to promote the advancement of biology as a science by encouraging research, the imparting of knowledge, the application of knowledge to the solution of biological problems, and the preservation of biological resources. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. See inside back cover.

TIME AND PLACE OF FUTURE MEETINGS

2008 April 16-19: Co-hosted by Furman University, Greenville, South Carolina, and Wofford College, Spartanburg, South Carolina.
2009 April 1-4: Co-hosted by Jacksonville State University, Jacksonville, Alabama, and University of Alabama, Birmingham, Alabama.

**ASSOCIATION OF SOUTHEASTERN BIOLOGISTS
EXECUTIVE COMMITTEE MEETING
SATURDAY, 1 APRIL 2006
AZALEA ROOM, GLENSTONE LODGE
GATLINBURG, TENNESSEE**

ATTENDANCE: 19 individuals attended the meeting

NAME	CAPACITY
Kim Marie Tolson	President
Dwayne Wise	Past President
Michael Dennis	President-Elect
Bonnie Kelley	Vice President
Debbie Moore	Secretary
Tim Atkinson	Treasurer
Scott Franklin	Member-at-Large
Elaine J. Davis	Member-at-Large
Dennis Haney	Member-at-Large
Don Roush	Member-at-Large/BBB
Wayne VanDevender	Member-at-Large
John Herr	Archivist, LAC 2007 Chair
James Caponetti	Print Editor
Virginia Martin	BBB
Scott Jewell	Meeting Coordinator
Randy Small	LAC 2006 Co-chair
Patricia Cox	LAC 2006 Co-chair
Joe Pollard	LAC 2008
Tom Wentworth	Past Vice President

President Kim Marie Tolson called the meeting to order at 8:06 am.

President's Opening Remarks—Kim Marie began the meeting by asking for introductions of those in attendance. Kim Marie indicated that her motto for the upcoming year would be "Change is good". There will be some changes made within ASB in an attempt to promote a more professional organization. The two things that allow us to present ourselves to the scientific community are our website and our publication, *Southeastern Biology*. We will be looking at ways to improve those. Changes to Executive Committee meetings will involve reports—oral reports will be given for things that require EC action or approval; general reports will be distributed and read into the minutes.

President's Report—Kim Marie reported that she had contacted all individuals that serve on ASB committees to inquire about their interest in continuing to

Outside front cover photo: Lieber College, constructed in 1837 as a double-residence for faculty. It is named after Professor Francis Lieber, abolitionist of the mid-19th century and champion of human rights, and it was the home of Andrew Charles Moore (left entrance), first chair of the Department of Biology, 1905-1928.

serve on that committee. If there was no response from an individual after two to three messages were left, then they were removed from the committee. She indicated that almost all committees had been staffed for the upcoming year. A few positions were left open and would be filled by persons who inquired about committee service at the Annual Meeting. A complete list of committee assignments will be sent to Jim Caponetti for publication in *Southeastern Biology*, and to the web editor for posting on the ASB website.

No other Officer's Reports were given.

BBB Report—given by Don Roush and Virginia Martin. There was only one no-show and that was a poster, all papers were presented. Some of the posters were oversized as the students failed to follow instructions. This will be stressed next year.

Committee for Human Diversity Report—submitted by Victoria Turgeon and presented by K.M. Tolson. (This committee was formerly the Committee for Women, Minorities and Persons with Disabilities.) The Committee held a workshop/pizza luncheon with invited speakers presenting information on choosing careers in Biology. Sixty people attended the workshop and it was deemed highly successful. Plans are for a similar format in Columbia and the topic will be "Mentoring".

Patron Members and Exhibitors Committee Report—given by Tom Wentworth. There was 100% attendance at the first ever ASB Patron Members Breakfast on 30 March 2006. Tom prepared a brief program for the breakfast that included a discussion of ASB's vision for Patron Members. It was decided that this should be an annual event. Bonnie Kelley, newly elected Vice President, will be in charge of the breakfast in Columbia, SC.

Publications Committee Report—no formal report was given by Chair, Elaine Davis, but a discussion was conducted concerning the need for four issues of *SEB*, changing the content of individual issues, and the possibility of allowing advertising in *SEB*. The Publications Committee was charged with bringing to the September EC meeting a set of guidelines defining acceptable advertising. Dwayne Wise made a motion that the EC approve advertising in all issues of *SEB*; a second was given by Tim Atkinson; motion passed.

Graduate Student Support Award Committee—A question was raised concerning the amount of money that was available each year as it appeared to fluctuate. Tim explained that a certain amount is budgeted each year, then adjusted for the number of applicants. Usually there is more money budgeted than requested. The Chair of the committee should be notified of how much money is budgeted and plan accordingly.

Break 8:50 am. Reconvene 9:08 am.

NEW BUSINESS

NABT Affiliation: Dwayne Wise led the discussion. NABT would like to affiliate with us—not have their meeting with us, but just be at our meeting. They would like to incorporate their Regional meeting with us and have local teachers attend workshops, etc. Dwayne was charged with pursuing NABT affiliation and what would be required of us.

Nominations for Office or EC Member-at-Large: Last spring there was a problem with a nominee who was not current with their dues. The Handbook for Officers and Committees describes the duties of the Nominating Committee; however, it needs a revision to charge the Chair with ensuring that all persons nominated for an office are members of ASB. This should come before the EC as a motion from the Nominating Committee.

Committee Portfolios: Dennis Haney volunteered to work out a system that will improve passage of portfolios from one chair to the next. The portfolios and the information they contain are vital to maintaining continuity from one year to the next.

Committee Restructuring:

Education Committee—The Bylaws read that this committee is supposed to be made up of 6 members, with two appointed annually. However, only one new member had been appointed for several years until Dwayne added three (ad hoc?) members last year. It was suggested that this committee bring forth a motion to the EC to reduce the number to 3 members so that it would be more in line with other ASB committees. Kim Marie will contact Ricky Fiorillo, Chair of the Education Committee for 2006-2007, and get their input.

Poster Awards Committee—This was a very difficult committee to decipher for Kim Marie. The Bylaws read that this committee is supposed to be made up of 3 members. However, with the increased numbers of poster presentations made at recent ASB meetings, there has been a necessity to add ad hoc members by previous Presidents to ensure that all posters were judged. The confusion arose when committee members did not know if they were a regular member or an ad hoc member, if they were to serve three years or only one year, or even who exactly was supposed to be the Chair of the committee. Kim Marie will appoint one new member for a three year term and three ad hoc members for a one year term. Consideration will be given to make sure that different disciplines of biology are represented by committee members. Kim Marie will contact Irene Kokkala, Chair for 2006-2007, and request a motion to change the committee structure.

Research Awards Committee (Student)—This committee is currently judging two awards—the Martin Microscope ASB Student Research Award (\$1,000) and the Brooks/Cole Aquatic Biology Award (\$200). While this is mentioned in the Handbook, there is no mention of two separate awards in the Bylaws. There was discussion as to whether the two should be separated or not. It was decided that, for the time being, the number of manuscripts that were being received for both awards combined was not overwhelming for the committee of three to judge and it would be left as is for now.

Microbiology Research Award Committee—this award (\$500) is sponsored by Thomson Brooks/Cole. It is not in the Bylaws or in the Handbook. It was discussed as to whether changes needed to be made to either. The EC agreed that since this was not an ASB award it did not need to go in the Bylaws, but that it should be added to the Handbook. Dennis Haney questioned what all specific topics were covered by this award—that cell biology, genetics and

molecular biology are not necessarily micro. A description will be written by Don Roush for inclusion in the Handbook.

Enrichment Fund: Bonnie Kelley is now serving as Chair of the Enrichment Fund. Kim Marie appointed an ad hoc committee consisting of Bonnie Kelley, Dwayne Wise and Mike Dennis to study the description of the committee, to determine how the funds should be used, and to bring forth recommendations at the September EC meeting.

Friday Night Awards Banquet: The general opinion of the Friday night banquet is that it is too long and that it moves too slowly. Dwayne Wise suggested that we discontinue with the presentation of certificates to each individual Committee Chair and EC member who is rotating off. Their names would be called and they would be asked to stand for recognition. The certificate would be replaced with a letter of recognition and appreciation from the Past President to the persons being recognized. It was also decided to dispense with the Past President's after dinner speech.

Meetings Coordinator Report: Kim Marie asked Scott Jewell, the contracted Meetings Coordinator, if he would provide the EC with a report at the September EC Meeting and at the Wednesday EC meeting of the Annual Meeting. Scott Jewell indicated that he would be more than happy to provide a report of his activities for ASB business to the EC.

Web Editor: Kim Marie will appoint a new Web Editor within the next month. Several candidates have been mentioned. As soon as this is done, she will notify the EC and Jim Caponetti. The site will still be maintained at Appalachian State.

Fall EC Meeting: A date and location has not been set. Joe Pollard will work with Scott Jewell for a possible site in Greenville, SC.

SEB: Jim Caponetti stated that, due to a recently approved increase in membership dues, we will need to raise the nonmember price on issues of *SEB* to \$10, or \$40 for 4 issues, effective January 2007. All were in agreement.

Voting status of ex-officio members: John Herr brought up that the non-voting status for Jim Caponetti should be evaluated since he is affected by many issues. The Bylaws were reviewed and show that the Print Editor does have the authority to present motions before the EC. Jim indicated that he was comfortable with that.

2007 Budget: Tim Atkinson did not have a proposed 2007 budget for approval. He will be working to have one ready for the December issue of *SEB*.

OLD BUSINESS

2006 LAC: Pat Cox, Randy Small and Scott Jewell gave a preliminary report on the Gatlinburg meeting: 981 formal registrations, 1078 at Thursday night social, 371 at banquet, record number of field trip attendees, record number of exhibitors, silent auction raised approximately \$1,200. The LAC is tentatively projecting they will clear in excess of \$44,000 for this meeting. The EC thanked them for their hard work and concluded that the meeting was an unqualified success.

There being no further business the meeting was adjourned at 10:33 am.

**ASSOCIATION OF SOUTHEASTERN BIOLOGISTS
EXECUTIVE COMMITTEE MEETING
SATURDAY, 9 SEPTEMBER 2006
PALMETTO EXPO CENTER
GREENVILLE, SC**

ATTENDANCE: 17 individuals attended the meeting

NAME	CAPACITY
Kim Marie Tolson	President
Dwayne Wise	Past President
Michael Dennis	President Elect
Bonnie Kelley	Vice President
Debbie Moore	Secretary
Tim Atkinson	Treasurer
Elaine J. Davis	Member at Large
Scott Franklin	Member at Large
Dennis Haney	Member at Large
Jennifer Davis	Member at Large
Wayne VanDevender	Member at Large
John Herr	Archivist, 2007 LAC Chair
Jim Caponetti	Print Editor
Scott Jewell	Meetings Coordinator
Patricia Cox	2006 LAC co-chair
Joe Pollard	2008 LAC co-chair
Doug Rayner	2008 LAC co-chair

President Kim Marie Tolson called the meeting to order at 8:30 am.

Representatives from Palmetto Expo Center, Dee Dee Holden and Haley Scott, addressed members of the Executive Committee and welcomed them to Greenville, SC and the Expo Center. EC members introduced themselves and thanked Dee Dee and Haley for their hospitality.

Approval of Minutes: A motion was made and seconded to approve the minutes from the Wednesday EC meeting in Gatlinburg on 29 March 2006; motion passed.

Presidents's Report: Kim Marie reported that all committees had been staffed and the information had been sent to the Print Editor and Web Editor. In addition on new ad hoc committee on the Enrichment Fund had been appointed at the 1 April 2006 EC meeting in Gatlinburg. Affiliation of ASB with AAAS had been renewed and a letter has been received confirming our renewal. Tim Atkinson has volunteered to serve as the ASB representative to AAAS.

Past President's Report: Dwayne had no report but will have one at the April meeting.

President Elect's Report: Mike Dennis indicated that he had narrowed the Plenary Speaker down to four candidates. Plans are to have a confirmation by 1 October and send that information to Jim Caponetti for inclusion in December issue of *SEB*.

Vice President's Report: Bonnie Kelley will be organizing the Patron's breakfast at the meeting in Columbia. Notes from Tom Wentworth indicated the one in Gatlinburg was tremendously successful. Discussion from EC members who attended the first breakfast confirmed that all the Patrons appreciated the special attention.

Enrichment Fund Report: Bonnie Kelley will contact the OBT from South Carolina when that information comes out in February and invite her to come to the meeting in Columbia.

Secretary's Report: Debbie Moore had no formal report.

Treasurer's Report: Tim Atkinson reported that earlier in the year we were in the red, but that we do have money now. The September issue of *SEB* cost less than expected because Jim had fewer printed. Most of the people who are renewing membership for 2007 are paying the new dues amount even though they do not need to.

Finance Committee Report: Tim had no report.

Membership Officer's Report: Given by Tim for Debbie Atkinson. The mailing list for the Sept. issue of *SEB* was 1233. There was a discussion on putting a searchable membership list on the web site.

--The President charged Dwayne Wise, as Web Editor, to bring to the EC meeting in Columbia, some information about a searchable membership list for the web site.

--The President charged Scott Jewell with contacting Frank Gillium who is with ESA. The ESA is developing an "expert opinions" database and plan to use the southeast region in their pilot program. The consensus of the EC is that this is definitely something ASB should be involved in.

Print Editor's Report: Questions were brought up concerning the duties of the Associate Editor and Business Manager—how they were appointed and if they were necessary. Discussion ensued. It was concluded that these were positions for *SEB*.

--The President charged Elaine Davis with chairing an ad hoc committee to look at other options for publishing/printing *SEB*. Members on this committee are Scott Jewell and Jim Caponetti and Elaine should delegate responsibilities as she deems necessary.

Web Editor's Report: Dwayne Wise reviewed the process by which a web designer was chosen. A one year contract was negotiated with Adam Jones that covers the period 15 July 2006 to 15 July 2007. First year services of designing a template with unlimited updates are \$740; second year would be \$240 with

unlimited updates if we choose to retain his services. The consensus of the EC was that ASB has a sleek, professional looking web site.

Break at 10:00 am, reconvene at 10:15 am.

Archivist's Report: John Herr requested that all committee reports should follow the designated format. The Secretary will email all Committee Chairs a copy of the format prior to the Annual Meeting. The EC had previously voted by email to have the archived ASB material put on the web by the library in Athens, GA. They have the go-ahead to do so, but we have not heard of their progress. Ron Dimock will be contacted and asked for copies of the letters that were written in support of his Meritorious Teaching Award.

Book Editor's Report: Debbie Moore reported that over the past calendar year there were seven book reviews in *SEB* written by ASB members and one written by a non-ASB member.

News Editor's Report: Given by Kim Marie for Ricky Fiorillo. Ricky was appointed after the 1 April 2006 meeting in Gatlinburg. He is running into the same issue that the previous News Editor had and that is lack of submissions. Ricky is currently exploring strategies to increase the submission of news items. These include: 1) a news drop box at the ASB desk at the Annual Meeting along with a form to fill out. There was discussion from EC members about posting "News" on the web site; 2) identify a volunteer from each state to serve as a news coordinator that would be responsible for collecting news from their state; and 3) the News Editor could send an email to members regarding news items—this would require that he have access to the membership database.

AFFILIATE REPORTS

Tri Beta: Don Roush was on the agenda to give the report but left this morning because of a family emergency. Please keep Don and his family in your thoughts and prayers.

Southeastern Fishes Council: A report was given by John Herr. John had received an email from their President saying that they would not be meeting with us in Columbia and are not sure that they will ever be meeting with us again. The implication was that they were interested in Organismal Biology and that ASB was not a good fit for them.

--The President will contact SFC and ask if they still want to be listed as an affiliate.

Other Affiliates: John Herr reported that the following affiliates would not be meeting with ASB in Columbia—SFC, SEEMS, ASIH and Southeastern Society of Parasitologists. Dwayne Wise commented that SEEMS was delighted with the ASB meeting in Gatlinburg. They needed to hold a separate meeting to get their finances in order and then they would be back.

--The President will contact ASIH to find out their future plans.

SABS: Pat Cox initiated a discussion on scheduling dates for the ASB Annual Meeting. The consensus of the EC is that it will not be a problem to schedule around the Wildflower Pilgrimage. The LACs consider those dates along with Easter weekend and the NABT meeting when scheduling the ASB Annual Meeting.

COMMITTEE REPORTS

Publications Committee: A discussion was held on the publication dates for *SEB* and what should be in each issue. The EC was in agreement that if abstracts were published AFTER the meeting, then the issue of no-shows having published abstracts would be taken care of. Also, if abstracts were not going to be published until the July issue, then the deadline for abstracts could be moved from November to January. This was viewed as a very positive move that could potentially increase the number of abstract submissions for the Annual Meeting. The EC approved the recommendation from Jim Caponetti and John Herr to publish *SEB* in the months of January, April, July and October. There will be a re-distribution of some items as well as consolidation of others to avoid repetition and reduce journal printing costs. Specific details of what will be included in each issue will be published in forthcoming issues of *SEB*.

LAC 2006, Gatlinburg: Pat Cox gave the final wrap-up of the Gatlinburg meeting with final numbers on registration and attendance of all events. Her final budget indicated that ASB made over \$51,000 from the Gatlinburg meeting. The money went straight from on-line registration into the ASB checking account. The EC expressed their deepest thanks to Pat for all the hard work that was done by her and other members of the LAC to make this meeting so successful.

LAC 2007, Columbia: John Herr presented a preliminary budget for the Columbia meeting that was sort of a worst case scenario budget that reflected a registration of only 650 individuals. This number would generate a profit of \$3400. But if there are 175 more students and 175 more regular registrants, then we will take in another \$35,000. There was discussion on the cost for students to attend the Friday banquet. It was suggested that Patrons be asked to help defray the cost of students for the banquet. John has given Jim Caponetti copies of maps to include in the December issue of *SEB*. The Herbarium at USC is offering a \$500 award to a student in their department who has the best paper on plant studies at this meeting. All USC students who enter for this award will have half of their registration fee paid to the meeting and will receive a one year membership to ASB as well.

LAC 2009: Scott Jewell reported that we are looking at holding the 2009 meeting in Alabama and that potential sites are Birmingham and Mobile. We have much more leverage if we get two sites competing for our business.

Lunch break at 12:00, reconvene at 1:00 pm.

LAC 2008: Joe Pollard reported on negotiations for the location of the 2008 meeting between facilities in Greenville and Spartanburg, SC. Discussion was held on the merits of both sites. Greenville had an excellent meeting facility, but

did not offer the proximity to hotel facilities. The consensus of the Place of Meeting Committee was to hold the 2008 meeting in Spartanburg at the Marriott with Furman University and Wofford College serving as Co-Hosts. The Place of Meeting Committee was thanked for all of their efforts and recognized for not just doing a lot of work, but doing a lot of really good work.

Education Committee: Ricky Fiorillo brought forth a motion from the Education Committee: "The Education Committee shall consist of 3 members appointed for 3 year terms with one member appointed annually to serve as chair in the 3rd year." Currently ASB Bylaws state the committee shall consist of 6 members appointed for 3 years with 2 members appointed annually to serve as co-chairs in the 3rd year. This motion was made to keep the Education Committee in line with other ASB Committees that do comparable work. This motion comes from Committee so it does not require a second. Discussion. Vote: all were in favor; motion passed.

The Education Committee is planning to hold a workshop in Columbia for students who are planning to enter graduate school or enter the work force.

Poster Awards Committee: Irene Kokkala brought forth a motion from the Poster Awards Committee: "The Committee shall consist of 6 members appointed for terms of three years with two members appointed annually and serving as co-chairs the 3rd year. Special attention should be given to the field of expertise of the members, to allow for diverse representation within the committee in order to provide adequate and fair judging of the posters." Currently ASB Bylaws state that the committee shall consist of 3 members and this number is not sufficient to cover the increased number of posters that are submitted for judging. This motion comes from Committee so it does not require a second. Discussion produced a friendly amendment "The Committee shall consist of 6 members appointed for terms of three years with two members appointed annually and serving as Chair and Vice Chair the 3rd year." Second. Discussion. Vote: all were in favor, amendment passed. Vote to accept motion as amended: all were in favor; motion passed.

Committee for Human Diversity: Victoria Turgeon is requesting that the EC approve the spending of \$300 for pizza to be served at their workshop that will address the subject of "Mentoring". A motion was made to approve the requested amount; a second was received; discussion. Vote: all were in favor; motion passed.

OLD BUSINESS

Publications: The Publications Committee recommends that we use the same process that was used in Gatlinburg and provide a Program at a Glance for meeting registrants. The cost of printing may be included in the registration fee or seek sponsors to defray printing costs. Possibly offer them recognition on the back cover. There would be no advertisements in it.

EC members were reminded that we had voted to allow advertising in all four issues of *SEB*. Potential advertisers will be directed to contact Scott Jewell for rates.

Compleat Naturalist: A review of past minutes indicated that the Compleat Naturalist from Ashville, NC had expressed an interest in sponsoring an ASB award. Claudia Jolls indicated in her Past-President's report that she had not pursued them since Gatlinburg. Attempts will be made to contact them and recruit them as an award sponsor.

Ad Hoc Enrichment Fund Committee: An ad hoc committee was appointed in Gatlinburg to study Enrichment Fund business that consisted of Dwayne Wise (Chair), Bonnie Kelley and Mike Dennis. Dwayne began the report by saying that the objective(s) of the Enrichment Fund has not always been clear. At some point we came up with sponsoring the OBT from the state in which we meet. That is going well and is a good project. Beyond that we did not have a definition for Enrichment and no real idea about where it should go. The ad hoc committee is proposing some fairly aggressive plans: First, is to set an Enrichment target that would be reached by a defined year. We currently have a little over \$40,000 in the EF and would like to see that reach \$100,000. Second, when the goal is reached, the ad hoc committee proposes to fund grants to the following categories of people 1) undergraduates in Biology, 2) graduate students, and 3) high school biology teachers. This program would be modeled after the Sigma Xi Grants-in-Aid of Research program with a fairly simple web-based grant application required and a supporting letter from the mentor. The plans for the Enrichment Fund will be revealed at the Columbia meeting where the EF will have a booth/table to promote their proposals.

NABT Affiliation: Dwayne Wise will go back to NABT and promote the idea of affiliating with ASB.

NEW BUSINESS

Symposia Proposals: Proposals for symposia at the Columbia meeting were brought before the EC for approval. The EC felt that all of the proposals had merit and gave them their support. The LAC will incorporate them into the program providing there is adequate time and space to support their needs.

--The President charged Scott Franklin with developing a protocol and schedule for submitting symposia proposals for ASB meetings.

Banquet Business: Changes will be made to the Friday night Awards Banquet to decrease the length of presentations and create a more professional atmosphere. There will no longer be a past-president's speech.

There being no further business, the meeting was adjourned.

ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

68TH ANNUAL BUSINESS MEETING FRIDAY, 20 APRIL 2007 COLUMBIA METROPOLITAN CONVENTION CENTER COLUMBIA, SOUTH CAROLINA

President Dr. Kim Marie Tolson called the annual ASB business meeting to order at 10:35 am, Friday, 20 April 2007. As of 10:00 am, there were 818 attendees registered; there was a round of applause. Dr. Tolson began the meeting in a similar fashion as the Wednesday night plenary session by calling for a minute of silence to recognize the tragedy that occurred at Virginia Tech.

1. Election of Officers—Kim recognized Executive Committee members, Elaine Davis, Jennifer Davis, and Bonnie Kelley, as the floor tellers, and ballots were dispersed to the members. All the nominees for each office were asked to stand to be recognized.

Members-at-Large had four nominees, and the membership voted for two. The nominees were Ron Dimmock, Wake Forest University; Katie Greenberg, USDA-Asheville, NC; Randy Small, University of Tennessee; and Doug Rayner, Wofford College. There was a call for nominations from the floor; being none, a motion was made to close the nominations, seconded, and the motion was approved.

Secretary had only one nomination: Nicole Welch, Middle Tennessee University. There was a call for nominations from the floor; being none, a motion was made to close the nominations, seconded, and the motion was approved.

Vice President nominees were Rebecca Cook, Lambuth University and Patricia Cox, TVA heritage program, Knoxville, TN. There was a call for nominations from the floor; being none, a motion was made to close the nomination, seconded, and the motion was approved.

President-Elect nominees were Scott Franklin, University of Memphis, and Tom Wentworth, North Carolina State University. There was a call for nominations from the floor; being none, a motion was made to close the nomination, seconded, and the motion was approved.

Dr. Tolson thanked the nominating committee consisting of Chair Claudia Jolls, Mike Dennis and Diane Nelson for a job well done. The members proceeded to vote and the ballots were collected by the floor tellers.

2. Approval of the Minutes—The minutes for the 67th annual ASB business meeting held in Gatlinburg, TN, on 31 March 2006 were published in the September 2006 issue of *Southeastern Biologist* 53: 332-333 as submitted by secretary Terry Richardson. A motion was made and seconded to approve the minutes. There was no discussion and the minutes were approved by the members present.

3. Changes to the ASB Bylaws—Two items on the agenda for changes in the bylaws require a vote by the members at the annual meeting. Both of these items

concern the structure and descriptions of two committees, and these recommendations were submitted by the current committee chairs.

a. Poster Award Committee: Currently there are only three members, one appointed annually, and rotating to chair in the third year. They are requesting that the number of the committee members be increased to SIX to accommodate the increasing number of posters being submitted for award consideration. There would be two members appointed yearly and in the third year would rotate to chair/co-chair. This will also enable members to represent the various biological disciplines reflected in the poster submissions. The motion was seconded. Call for questions? Wayne VanDevender asked how the committee would handle split votes. Kim: We will leave that up to the committee. The formal descriptions will be published in *SEB*. All approved.

b. Education Committee: Currently there are six members and the committee is making a motion to reduce the number to three since six members are not required to do the duties as described in the bylaws. The motion was seconded. No questions. All Approved.

4. Report from the Enrichment Fund—Bonnie Kelley, Vice President and Chair of the Committee. For the past five years, the enrichment fund committee has determined who the Outstanding Biology Teacher is for the state in which the meeting is held, and they are invited to attend and be recognized at the Annual Meeting. This year's recipient is Allene Barans of Charleston, SC. She and her husband Charles have enjoyed themselves so much that they have both joined ASB. Allene has a B.S. degree from Marquette University and a M.S. degree from William and Mary University.

5. Report from the Ad Hoc Committee for the Enrichment Fund—Dwayne Wise. Dr. Tolson formed an ad hoc committee to address issues of the Enrichment Fund and appointed Dwayne Wise (Past President and past chair of the committee), Mike Dennis (President-elect and past chair of the committee) and Bonnie Kelley (Vice President and current committee chair). The committee recommends that ASB begin a capital campaign in order to raise money for the Enrichment Fund. There is a lofty goal: by the end of 2008, there will be \$100,000 in the fund and by the end of 2010, \$200,000. This campaign is being spearheaded by the Past Presidents of ASB, and, as of this morning, 17 individuals have already donated \$1,770. They want to encourage all ASB members to contribute, and these contributions are tax deductible.

Goal: To provide \$2,000 grants to undergraduates, graduate students, high school biology teachers, college professors, etc. The application process would mimic the Sigma Xi Grant-in-Aid program. Once guidelines have been established, they will be published in *SEB* and on the ASB website. Applications will be submitted online.

The amount of money spent each year will be based on interest earned from the fund. The Principle would not be spent. So, the more money we have in the fund, the more grants that can be funded.

6. Secretary Report—Interim Secretary, Patricia Cox. Recognition of ASB deceased members. Madeline Burbank, Ronald Cowder, Clay Sellers and Fred Norris were recognized. A request was made for other names and Al Radford’s name was submitted.

Recognition of ASB members requesting Emeritus Status: Richard Henson, R. Dale Thomas, Thomas Fox, James Jackson, George Sawyer, and Virginia Martin. Motion made, seconded, and all approved to extend emeritus status to the above individuals.

At this time, Kim asked that we again observe one minute of silence in memory of our deceased members.

7. Treasurer Report—Tim Atkinson. A copy of the treasurer’s report is published in *SEB*. The financial report submitted is basically a snapshot of our finances on December 31, 2006. This does not necessarily reflect our actual financial stability since we tend to have our ups and downs. This balance shows that after we spent all our money and paid all our bills, all that was basically left in our checking account was the money from the Enrichment Fund. But if the picture would have been taken at the end of March, we would have had over \$110,000 in our accounts with over \$71,000 in checking. This reflects the money coming in from dues and registration for the ASB meeting. At one point during the year, money had to be borrowed from the Enrichment Fund to the checking account in order to pay bills. That money has now been transferred back into the Enrichment Fund. Tim commented on how this picture has been changing rapidly year after year and the importance of keeping membership costs and meeting costs in line with the increasing cost of our doing business.

8. Adjournment—Kim thanked everyone for attending the business meeting and reminded everyone about the Awards Banquet and requested that all presenting awards should talk with her to make sure they were on the Banquet agenda. The meeting was adjourned at 11:30 am.

9. Election Results: (Announced at the Friday night awards banquet)

President-Elect	Tom Wentworth
Vice President	Patricia Cox
Secretary	Nicole Welch
Members-at-Large	Doug Rayner
	Katie Greenberg

Respectfully submitted
Patricia B. Cox, Interim Secretary
1 June 2007

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Authors Sorted by Last Name
(Numbers = abstract number; P = poster)

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ASB PAPER SESSION ABSTRACTS

THURSDAY, APRIL 19, 2007

MORNING SESSION

Symposium I — Ecological Impacts and Coastal Ecosystem Resiliency Following Hurricane Katrina

- 1 QUATTRO, JOSEPH¹, MARK ROBERTS¹, JAMES GRADY² AND WILLIAM DRIGGERS³. University of South Carolina-Columbia¹, University of New Orleans² and National Marine Fisheries Service³—Potential impacts of hurricane Katrina on local populations of grass shrimp (*Palaemonetes pugio*).

We examined mitochondrial DNA diversity in approximately 200 samples of grass shrimp (*Palaemonetes pugio*) collected before and immediately after hurricane Katrina. Our previous genetic work suggested significant population-level genetic subdivision in this species pre-Katrina, and we were interested in the potential impacts of this event on genetic differentiation among coastal populations. An Analysis of Molecular Variance (AMOVA) that nested pre-Katrina and post-Katrina samples as 'regions' (with five 'impacted' coastal populations collected from Alabama through Louisiana nested within these regions) was used to detect significant genetic differentiation before versus after the storm. Preliminary analyses suggest that a large significant, but interestingly, negative component of genetic variance can be attributed to pre- versus post-Katrina differentiation, a result that can be attributed to sampling of two rather divergent genetic lineages in one sample (Cocodrie, Louisiana). When this sample was removed, genetic differentiation across time (pre- versus post-Katrina) was small, negative but non-significant, and a larger proportion of the total genetic variance was found among samples within any one year. Our results suggest that hurricane Katrina has had minimal impact on the population genetics of this common estuarine species.

- 2 WALKER, SAMUEL P.¹, DWAYNE E. PORTER¹, MADILYN FLETCHER¹, AND MARK S. WOODREY². University of South Carolina-Columbia¹ and Mississippi State University²—Observing Hurricane Katrina Impacts and Responses in the Grand Bay, MS National Estuarine Research Reserve.

This study assesses impacts of Hurricane Katrina at the Grand Bay, MS, National Estuarine Research Reserve (NERR) – an environmentally rich habitat that is part of the National Oceanographic and Atmospheric Administration's (NOAA) NERR System. We proposed to: 1) help reestablish storm-damaged monitoring instrumentation and data streams crucial for tracking time-scales of recovery in this ecosystem; 2) assess initial impacts of Hurricane Katrina on estuarine and upland groundwater water quality and marsh vegetation condition; and 3) develop a rapid assessment plan for the Grand Bay NERR that would guide the collection of perishable data in future storm events. The salt marsh estuary quickly readjusted after Hurricane Katrina, and there were no marked impacts on marsh vegetation or estuarine habitat. Accordingly, the team is developing a rapid response plan to facilitate documentation of near-term impacts in future storm events. The plan will also serve as a template for other NERRS sites. Subsequent monitoring also determined that there was no groundwater intrusion within 1 month after the storm, although possible slow intrusion in the longer term will be monitored. The salt marsh habitat contrasts markedly with developed areas, which experienced extreme damage -- it was markedly resilient when challenged with hurricane impacts, although longer term change caused by increased salinity runoff from the upland forest is still a possibility. Combined with existing baseline information for this estuary, this study

provides a basis for subsequent research addressing long-term resiliency of pristine coastal salt marsh estuaries.

- 3 PINCKNEY, JAMES L., MEGHAN JELLOE, MICHAEL COGGINS, AND DANIELLE JOHNSON. University of South Carolina-Columbia—Phytoplankton community structure responses to urban effluent inputs following Hurricane Katrina.

The floodwaters pumped back into Lake Pontchartrain contained toxic chemicals, carcinogens, pathogens, and human waste as well as high concentrations of nitrate and phosphate. The rate of loading of these contaminants was unprecedented and presented a unique opportunity to describe ecosystem responses to this catastrophic event. Documentation of changes in phytoplankton community composition provided a sensitive bioindicator for quantifying potential shifts in ecosystem structure in the weeks following Hurricane Katrina. The overall objective was to quantify the short- and long-term responses of the phytoplankton community to massive inputs of untreated floodwaters into Lake Pontchartrain. Water samples were collected weekly from 15 September to 15 December 2006 at several stations in Lake Pontchartrain by a Research Team at LSU. Filtered samples were analyzed by HPLC to quantify photopigment concentrations and relative abundances of algal groups were calculated using ChemTax. The phytoplankton response to effluent inputs was limited to the immediate vicinity of the outfalls and algal concentrations returned to normal levels within 45 days after the passage of Hurricane Katrina. Chlorophyll *a* concentrations peaked at 25 $\mu\text{g l}^{-1}$, much below “bloom” concentrations. Diatoms and euglenophytes were the most abundant algal groups in the effluent plume. This event offered a unique opportunity to observe how ecological processes in Lake Pontchartrain were altered following the catastrophic addition of millions of gallons of untreated effluent. Overall, the impacts of effluent inputs were limited to 45 days following the storm and the system quickly returned to “normal” conditions.

- 4 KUPFER, JOHN A. University of South Carolina-Columbia—Patterns and controls of forest damage following Hurricane Katrina in DeSoto National Forest, Mississippi.

Using field sampling and air photo classification, we categorized forest damage resulting from Hurricane Katrina in a 153,000 ha landscape in southern Mississippi into three classes: low, moderate, and heavy. We then developed predictive damage models using single tree classification tree analysis and stochastic gradient boosting (SGB) and examined the importance of variables addressing storm meteorology, stand conditions, and site context in predicting forest damage. Overall damage classification accuracies for a 290-plot training dataset were 72% and 93% for the single tree and SGB models, respectively; these values dropped to 56% and 61% for a 72-plot independent validation dataset. Producer's and user's accuracy for the SGB model showed marked improvement for both datasets. Distance to streams and slope aspect were the best predictors of damage for both models while measures of storm meteorology along with hardwood basal area, slope, and stand condition were of secondary importance. Our results indicate that broad-scale damage prediction for a given event is feasible and clarify how physical and biological factors interact with one another to determine hurricane damage.

- 5 MOORE, J. E¹., J. KUPFER², S PIERCE¹ and S. B. FRANKLIN¹. University of Memphis¹ and University of South Carolina-Columbia²—Effects of Hurricane Katrina on Southern Mississippi Coastal Forest soil and water chemistry.

Forest recovery following natural disturbance is a function of effects of the disturbance on existing communities, responses of surviving individuals to changing and often stressful environmental conditions based on species-specific adaptations and life history traits, and

germination and establishment of new individuals from the soil seed bank or colonization. Effects of storm surge on coastal ecosystems included mechanical damage from waves, salt spray damage, and chemical alterations of the soil. To examine the effects of storm surge on coastal soils, we performed repeat sampling of water and soils in storm surged and non-storm surged forests and salt marshes located around St. Louis Bay, MS. One month after hurricane Katrina, storm surged water bodies showed statistically higher conductivity and salinity compared with non-storm surged areas, both in coastal forests and salt marshes. In the storm surged soils, conductivity and salinity decreased from October to February, while dissolved oxygen increased. There was an increase in soil pH from October to February in non-storm surged soils with no change in storm surged soils. Soils in storm surged areas had significantly higher concentrations of sodium, phosphorous, magnesium, calcium, and potassium during October, December, and February samplings following Katrina. Hydric soils seemed to maintain higher concentrations for a longer period of time. Effects of the surge certainly lasted into the growing season following the late summer hurricane.

Plant Biology I

- 6 LLOYD, MICHAEL W. AND ROLAND P. ROBERTS. Towson University—Genetic structure of six North American populations of *Arabidopsis lyrata* spp. *lyrata*.

This study investigated the genetic structure of six populations of *Arabidopsis lyrata* spp. *lyrata*. Specifically, we assessed the extent of gene flow within and among the populations. Common garden experiments revealed phenotypic variation that appeared to be linked to habitat, as a result, a more in dept investigation of these populations was deemed necessary. The study employed the use of neutral genetic markers to ascertain the degree of population admixture. Analysis of data from three microsatellite loci using AMOVA showed most of the variation was present within individuals (80% within individuals). There appeared to be no substructuring within populations (i.e. individually sampled sites; 0% among individuals within populations). Finally, geographic regions explained 20% of the variation. Further analyses using Structure v2.1 resolved population structure to geographic regions indicating the importance of geographic distance in isolating these populations. *A. lyrata* spp. *lyrata* exists in a patchy matrix, is an obligate outcrosser, and a poor disperser, therefore isolation by distance effectively limits gene flow among populations. The addition of 3 other loci and an increase in allelic diversity may further support this conclusion. A larger more informative data set will ultimately increase the reliability of conclusions drawn from this study.

- 7 ELLIS, JENNIFER R. AND DAVID E. MCCAULEY Vanderbilt University—EST-SSRBased Approach to Studying the Population Genetics of an Endangered Sunflower.

Studying the population genetics of endangered species is important because such populations are subject to a variety of genetic threats when they are rare. Applying population genetic techniques to endangered species will also increase our understanding of the genetic architecture underlying adaptive evolution. In my research, I will study an endangered sunflower, *Helianthus verticillatus*, to address population genetics and conservation biology questions. Simple Sequence Repeats or SSR's have become the genetic tool of choice because they are highly polymorphic, abundant throughout the genome, codominant, and can be used with PCR based protocols. The SSR's in coding regions can be identified by analyzing databases of Expressed Sequence Tags (EST) with computer software that searches for these repeats. Here, I survey 22 EST-SSR's developed for *H. annuus*, in *H. verticillatus* and a common congener, *H. angustifolius*, for genetic diversity and population differentiation. I find that the rare species does not exhibit

lower genetic diversity but actually higher diversity than the more common species. Further, I test the hypothesis that *H. verticillatus* is a hybrid between *H. angustifolius* and *H. grosseserratus*.

- 8 NESS, JENNIFER M. East Carolina University--Introgression and self-incompatibility in *Leptosiphon* (Polemoniaceae).

Hybridization has long been argued to be important in the evolutionary dynamics of plant species and populations. A possible outcome of hybridization is introgression, the movement of genes across species boundaries. This has the potential to create new phenotypic variation for selection to act upon in the participating species. This study looks at the relationships between hybridization and pollen-pistil traits. Pollen-pistil interactions are likely to influence the strength and direction of introgression, and introgression, in turn, may contribute to variation in pollen-pistil traits within species. The study species *Leptosiphon androsaceus* and *Leptosiphon jepsonii* co-occur in northern California, exhibit self-incompatibility (SI) and a highly variable self-compatibility (SC) system, respectively, and appear to hybridize in the field. Variation in pollen-pistil traits in *L. jepsonii* occur both within populations and among them. The presence of this variation and evidence for hybridization with several congeners suggests the possibility that introgression could contribute to the variation among populations. Here I present evidence for the existence of a hybrid zone using morphological characters and a discriminant function analysis. In a complementary study, multiple generation hybrids were created in greenhouse crossing experiments. The initial hybrid crosses exhibited unilateral incompatibility. This finding is consistent with the SI x SC rule, which states that an SI species cannot accept pollen from an SC species but the reverse is compatible. First generation hybrids were found to be SI, suggesting that SI is dominant to SC, and later generation hybrids and backcrosses showed segregation of SI.

- 9 TAYLOR, MACKENZIE L. AND JOSEPH H. WILLIAMS. University of Tennessee--Fertilization timing and the pollen tube pathway in *Brasenia* and *Cabomba* (Cabombaceae, Nymphaeales).

Successful fertilization in flowering plants depends on developmental processes in four genetically distinct entities, the male sporophyte, female sporophyte, male gametophyte, and female gametophyte. In the period between pollination and fertilization, interactions between developing gametophytes are mediated by sporophytic tissues within the pollen tube pathway. These interactions allow for an increased opportunity for pre-zygotic mate discrimination and more efficient nutrient partitioning by the maternal plant, and have been linked to the evolutionary success of angiosperms. However, relatively little is known about the processes that operate between pollination and fertilization in the recently defined basal angiosperms. A range of molecular and morphological studies indicates that the Nymphaeales, or water lilies, comprise one of these earliest lineages of flowering plants. The family Cabombaceae encompasses two water lily genera, *Brasenia* and *Cabomba*. An investigation of the developmental events that occur between pollination and fertilization in *B. schreberi* and *C. caroliniana* was undertaken in Tennessee and Alabama during the summer of 2006. Experimental pollinations and sequential collections were carried out and the duration of stigma receptivity, onset of ovule receptivity, pollen germination, ovule entry, and fertilization were documented in both genera. In addition, the pollen tube pathways were determined. These results will be discussed within the context of the evolution of Nymphaeales and of basal angiosperms as a whole.

- 10 WEBER, JENNIFER AND CAROL GOODWILLIE. East Carolina University – Reproductive assurance by self-fertilization in *Leptosiphon jepsonii*.

Autonomous selfing is predicted to provide the benefit of reproductive assurance in low or fluctuating pollinator environments. Our goal was to quantify reproductive assurance in *Leptosiphon jepsonii*, an annual plant species of the California North Coast Range. Individuals of *L. jepsonii* show variation in the timing of self-fertilization from early selfing to delayed selfing via a transient self-incompatibility system. Further, populations of *L. jepsonii* exhibit variation in the frequency of early and delayed selfing individuals, creating a gradient of outcrossing rates across populations. It is generally assumed that both early and delayed selfing confer reproductive assurance in the absence of pollinators, suggesting a “best of both worlds” scenario for delayed selfing individuals. However the effectiveness of delayed selfing through transient self-incompatibility at conveying reproductive assurance has not yet been determined. We hypothesize that early self-compatibility confers higher reproductive assurance, providing an adaptive explanation for the presence of early self-compatible variants in many populations. Pollination experiments were performed in three populations known to vary in outcrossing rate and in the frequency of early self-compatible individuals. Reproductive assurance by selfing was quantified by comparing seed set in emasculated and unmanipulated flowers with open pollination. Comparison of seed set in unmanipulated and pollen supplemented flowers quantified the magnitude of pollen limitation. In addition pollinator observations and density measurements were made at each field site to determine the mean number of pollinator visits per flower per day.

- 11 GOODRICH, KATHERINE¹, MICHELLE ZJHRA² AND ROBERT RAGUSO¹. University of South Carolina-Columbia¹ and Georgia Southern University²—Floral biology and molecular systematics of *Asimina* and *Deeringothamnus* (Annonaceae).

The genera *Asimina* and *Deeringothamnus* (sister taxa; Annonaceae) provide excellent models for the study of early Angiosperm diversification, since they are temperate genera from a predominantly tropical family of basal Angiosperms. Presented here are the preliminary results from a study on floral biology of *Asimina* and *Deeringothamnus*, as well as a co-occurring species of *Annona* (a closely related outgroup). A molecular phylogeny will be constructed using multiple gene loci, and floral traits (morphology and scent chemistry) will be mapped onto this phylogeny, with the goal of reconstructing the ancestral condition for each trait. The resulting phylogeny and character data will be used to address specific questions on the direction of floral evolution among species of *Asimina* and *Deeringothamnus* as they shifted between tropical, sub-tropical and temperate climates. Also presented is a completed study on the floral scent of *Asimina triloba*. *A. triloba* has the most extensive geographical range within *Asimina*, extending north to southern Canada and west to Oklahoma. Flowers of *A. triloba* are maroon with a fermented odor and attract several families of beetles and flies. We compared floral volatile emissions from flowers 1) during different developmental stages (immature, female and male), and 2) during day vs. night. Scent was collected from attached flowers in the field and the laboratory (from cut branches in 10% sucrose), and also from dissected floral organs. We used standard qualitative and quantitative scent collection methods. Compounds were separated with gas chromatography-mass spectrometry (GC-MS) and identified using library matches and authentic standards when possible.

- 12 FOWLER, KADRIN E. AND JAY F. BOLIN. Old Dominion University—Pollination biology of *Pyxidanthera barbulata* Michx. (Diapensiaceae).

Flowering pixie moss, *Pyxidanthera barbulata* Michx., is a rare plant of narrow mid-Atlantic Coastal Plain distribution. There are two species in the genus *Pyxidanthera*, *P. barbulata* and *P. brevifolia* Wells. Pixie moss is a prostrate, evergreen subshrub associated with fire-dependent communities. Little is known about its breeding or seed dispersal. It has been suggested that *P. barbulata* is an obligate outcrosser. In field studies we observed only

vegetative reproduction. A preliminary pollination study was conducted during spring 2006. Flowers were bagged and emasculated in March and monitored until fruit maturation in May. Results support the hypothesis that *P. barbulata* is an obligate outcrosser; fruit and seed development were similar for both the control flowers and emasculated flowers, 92% and 85% of the base number of seeds respectively. Floral visitors were monitored and documented.

- 13 SHRESTHA, SUSHMA AND DAN K. EVANS. Marshall University--Marketplace plants used in ceremonial cleansing among highland Qechuans of Ecuador.

Ceremonial cleansing plays a vital role in indigenous societies where 'folk illnesses' such as susto and espanto ('fright or soul loss') are common. Indigenous Qechuans of Ecuador use cleansing plants to treat susto and other 'folk illnesses'. This study was done to record knowledge of plants used in ceremonial cleansing among highland Qechuans of Ecuador. Individual interviews were conducted with 22 vendors at 14 marketplaces. Plants were collected and pressed for voucher specimens used in taxonomic identification. A total of 102 species from 50 plant families were reportedly used for cleansing. Many plants recorded were also used as herbal remedies for ailments such as muscular pains, stomach problems, and depression. Cluster analysis demonstrated that markets of Pujilli and Banos were the most floristically related while Cuenca was the least related of the 14. Lamiaceae had the highest number of plant species (15) used in ceremonial cleansing. According to residual of regression analysis, Lamiaceae (12.89) was the most selected and Apiaceae (- 0.02) was the least selected plant family. The Andean region provided the greatest number of plant species (64), while native species totaled 53. Ecological positions of epiphytes may have precluded a greater use in ceremonial cleansing. Highest residual of RA demonstrated preferential selection of Lamiaceae over other plant families. Knowledge of plants used in ceremonial cleansing was prevalent throughout the study area with minor variation in species employed.

- 14 IACARELLA, LUKE AND DAVID VANDERMAST. Elon University—Does North Carolina contain a cornucopia of medicinal plants?

Interest in herbal medicine is on the rise, resulting in more people using herbal supplements and in some cases, poaching of native plant populations. We conducted this study to determine the state of peer-reviewed knowledge of medicinal plants native to the North Carolina. Using PubMed we have researched the peer-reviewed status of 90 vascular plants that are commonly proposed to have medicinal value in the non-scientific literature. Our results indicate that a remarkably small number of these species have verified medicinal values. We found that only 16 (17%) of the proposed medicinal plant species had been researched for medicinal value. For another 6 species (6%) there was no information found for the native species, but their non-native congeners had been researched. Our research suggests that most native plant species of North Carolina have not been analyzed for their medicinal properties though there is widespread belief that they have medicinal value. We have observed that the state of research into herbal medicines is far more advanced in other countries, particularly China, than in the U.S. Our finding that the non-native congeners of North Carolina plants have verified medicinal value indicates that research into the medicinal value of native plants is warranted.

Plant Ecology I

- 15 MICHAEL E. HELD^{1*} and JOE E. WINSTEAD^{2*} Saint Peter's College¹ and Southern Arkansas University²—Forest stands and development in disjunct mesic habitats in southwest Arkansas.

Nineteenth and twentieth century logging and cotton cultivation removed the original vegetation in southern and southwestern Arkansas. The past four decades of forestry have emphasized rotational crops of pines following abandonment of cotton plantations. Acquisition of a remnant (ca. 4 hectares) old growth forest stand and a 12 hectare abandoned (1956) farm provided for study of potential future forest development in preserves of this region. The Center for Teaching Excellence in Math and Science of Southern Arkansas University sponsored a forest analysis of permanent plots in the spring of 2006. At both sites *Liquidambar styraciflua* and several *Quercus* species contributed the greatest importance values. Sweetgum at the old farm site had an importance value of almost twice that of the old growth forest remnant (39.5% versus 22.3%). The contribution of various oak species to that measure was almost identical representing about 23%. Relative density of 25% of *Acer rubrum* in the old farm site indicates similarity to successional sites in the southeastern United States. The old growth stand showed a basal area value of 30.98 m²/ha compared to the younger successional forest stand of 19.97 m²/ha suggesting climax status for the older site. Sapling densities were relatively similar (ca. 3150 individuals per hectare). Of the ten most common saplings in each site, five (*Liquidambar styraciflua*, *Acer rubrum*, *Ilex opaca*, *Ulmus rubra* and *Carpinus caroliniana*), were present in both. However a coefficient of community similarity for the tree strata indicates the two communities are currently not the same.

- 16 CONNER, WILLIAM H.¹, KEN W. KRAUSS² AND THOMAS W. DOYLE². Clemson University¹ and U.S. Geological Survey²—Ecology of tidal freshwater forests in coastal deltaic Louisiana and northeastern South Carolina.

Gulf of Mexico and south Atlantic coastal ecosystems are undergoing forest dieback and decline from increasing tidal inundation, saltwater intrusion, and altered freshwater flow attributed to global climate change, variability, and anthropogenic activities. Permanent transects and forest research plots in Louisiana and South Carolina have been established to assess wetland health and condition in order to predict global change impacts on tidal freshwater systems. Specific differences in tree composition include a greater number of species and a greater density of trees in South Carolina, even in more saline areas. Flooded sites in both states are dominated by baldcypress and water tupelo. Baldcypress is dominant in all South Carolina plots, whereas water tupelo is dominant in 40% of Louisiana plots. South Carolina has higher percentages of swamp tupelo. Chinese tallow tree, a nonnative invasive, occurred only in one Louisiana site. Significant impacts from salinity intrusion and invasive species are likely to change plant distributions in the future. The recent occurrence of hurricanes along southeastern and gulf coastal areas has reinforced the importance of understanding the role of acute catastrophic events in shaping the distribution of species and the composition of plant communities. Storm surges bring large volumes of saline water inland where it infiltrates into the soil resulting in immediate death of trees or continued mortality for many months. This occurred in Louisiana forest sites when Hurricane Rita (2005) elevated water levels in Bayou Teche National Wildlife Refuge higher than in Mandalay National Wildlife Refuge, but elevated salinity at Mandalay for at least 9 months.

- 17 WICHMANN, BRENDA¹, THOMAS R. WENTWORTH¹, ROBERT K. PEET² AND MARJORIE BOYER. North Carolina State University¹ and University of North Carolina-Chapel Hill²—Unique non-alluvial wetlands of the southern Appalachian region.

The southern Appalachian region harbors numerous non-alluvial wetlands, traditionally called 'bogs'. These bogs contribute significantly to the regional plant species pool and are floristically diverse, containing both northern and Coastal Plain disjunct species. Because only cursory data exist for southern Appalachian bogs, we recorded vegetation plots in over 50 bogs dispersed across the mountains of North and South Carolina using

the Carolina Vegetation Survey protocol. Preliminary results suggest that the plant communities of these bogs are substantially more varied and less predictable than previously recognized, probably owing to their small size and insular nature. The majority are dominated by shrubs, but a few are open and dominated by sphagnum and sedges, thus resembling boreal bogs. Southern Appalachian bogs are being degraded and lost due to anthropogenic changes. Our research serves to document the vegetation structure and composition of these unique wetlands for historical, monitoring, restoration, and inventory purposes, and provides a classification of these plant communities that circumscribes and adds to types currently recognized in the U.S. National Vegetation Classification.

- 18 GRIFFITH, ADAM, KATHY MATHEWS AND ROB YOUNG. Western Carolina University—Soil characterization for river cane (*Arundinaria gigantea* (Walter) Muhl.) restoration in Western North Carolina.

River cane (*Arundinaria gigantea* (Walter) Muhl.) is one of only three species of bamboo native to the U.S. and was once found in abundance on floodplains of the southeast. Habitat for this species has been destroyed primarily by agriculture and development resulting in a significant cultural loss for the Eastern Band of Cherokee Indians (EBCI). River cane with the qualities required by EBCI artisans is now scarce in Western North Carolina. In response, the River Cane Restoration Project (RCRP) has been launched with the EBCI to characterize river cane sites in six counties in Western North Carolina. To date, 45 sites have been mapped in a GIS database and baseline data collected for maximum height of cane, culm diameter, culm density, elevation, areal extent, associated species, and soil characteristics. A typical river cane site has culms 3-5 m tall with an average diameter of 1.5 cm and is commonly found with *Juglans nigra* (black walnut), *Planatus occidentalis* (sycamore), and *Impatiens capensis* (jewelweed). Although *A. gigantea* is commonly listed as a facultative wetland species, none of the sites are located on hydric soils. Soil characterization is currently underway, with four soil cores at each site being analyzed for soil properties, sediment size, and nutrient level. Preliminary results indicate preference for loamy sand soil and higher levels of Al, Na, and Ca (near 0.8 mg/g). Data from the RCRP will be used to identify optimal biophysical site parameters for the plant and incorporated into future restoration projects.

- 19 LEE, MELISSA, MACIE J. BIERNACKI AND KARLA GAGE. University of Memphis—Heat Accumulation in Plants.

Plants as autotrophes are primarily limited by light availability and ambient temperature. These two major factors limit plant resources and its ability to invest energy to various competing functions. So, plant growth and phenology could be quantitatively represented as a function of accumulation of energy from light over time at favorable ambient temperature levels. Historically, effects of temperature on plants has been calculated using a measure of mean temperature or of degree days. However, these methods fail to take into consideration the effects of changing day length and daylight temperature. This novel approach takes into account facts that in general, daylight heat promotes photosynthetic activity, and night length and temperatures, reflect night heat accumulation affecting losses due to cellular respiration. Our study examines the consequences of daylight heat accumulation of selected species. Mathematical models incorporating daylight and night heat accumulation may be used to quantify plant resource accumulation and timing of plant phenology. This may help to redefine the biome and allow to model ecosystem distribution. Also, heat accumulation models may better account for climate change effects from the perspective of plants, and assist environmental managers in better prediction of plant phenological stages, for example in agricultural applications.

- 20 DUBERSTEIN, JAMIE. Baruch Institute of Coastal Ecology and Forest Science—Importance of microtopography in freshwater tidal swamps along the Savannah River.

Two areas of freshwater tidal forest areas were investigated along the Savannah River. Data on tree species and diameter were collected in thirty-two 10m x 10m plots and used in exploratory analyses to identify four communities: shrub, water tupelo, swamp tupelo, and water oak. Multiple response permutation procedures confirmed significant differences between species composition at both the community and the landscape level. Each tree was categorized as either being on the floodplain floor (hollows) or on an area of elevated microtopography (hummocks). When on hummocks, the height of the hummock was measured. The importance of hummocks at the species, community, and landscape level were investigated using confirmatory statistics. Significant differences were found relating to number of trees on hummocks in the shrub community, as well as in the swamp tupelo community. Species-specific analyses within these community types found that many species are found only on hummocks. However, microtopography does not appear to be as important in the water tupelo and water oak communities, both of which are found only in the western area. Landscape-level analyses were performed, revealing that *Acer rubrum* and *Fraxinus* species show opposite trends relating to microtopography in the two areas. Inferences between microtopography and water levels are made based on water level data from the two areas.

- 21 WYATT, JULIE L. Wake Forest University—Limiting similarity among coexisting early spring herbaceous species with logging history in Southern Appalachian cove forests.

Niche differentiation allows species coexistence by limiting how similar species can be if they are to co-occur. Within the diverse early spring herbaceous layer of rich cove hardwood forests of the Southern Appalachians, differentiation between species in resource use is not known. Logging of these forests results in decreased herbaceous species richness. In old growth forests with more species per plot, greater differentiation in resource use is expected. In previously logged forests, where less species co-occur, the pressure to differentiate resource use may be reduced. Potential competitive resources among coexisting herbaceous species include light, water and nutrients. Traits used as proxies for resource use ability consist of leaf shape, lobation, leaf number, succulence, plant height, thickest root diameter, rhizome diameter, total chlorophyll, chlorophyll a:b ratio and specific leaf area. I measured these traits for ten individuals, sampled at random, for all species present in early April within 40-0.25 m² plots at each site (three old growth and three hundred year old forests) in the Nantahala National Forest. All individuals in the 0.25 m² plots were mapped. Spatial maps were used to test whether traits are more or less similar for co-occurring species than expected by random. Significantly less overlap in traits between coexisting species than expected supports limiting similarity while more overlap than expected suggests character convergence. Frequency of limiting similarity was compared between old growth and hundred year forests to determine if co-occurring species in old growth forests differentiate more in resource use, thus allowing more species to coexist.

22 CANCELED

- 23 ROBERSON, CAROLJANE¹, HEATHER STEWART¹, SARAH CROSBY¹, KARTIKEYA SINGH¹, KELLY WILSON¹, SOLIMAR MARRERO², EVA DÁVILA², AND JOE POLLARD¹. Furman University¹ and Universidad Metropolitana, Puerto Rico²—Seasonal changes in nickel concentration of soil and stream water in three forests on ultramafic sites in North Carolina and Puerto Rico.

Ultramafic rocks and soils have peculiar chemistry, including low availability of calcium and high concentrations of magnesium and nickel. Our earlier studies showed significant accumulation of nickel in canopy leaves of ultramafic forests in North Carolina and Puerto Rico. The present research attempted to determine whether seasonal variation in weather and leaf fall affect nickel concentrations in soil and stream water. We sampled soils and water over the course of a year from a temperate deciduous forest (Buck Creek, NC), a dry tropical forest (Susúa, PR), and a humid tropical forest (Maricao, PR). Organic layer (O-horizon) and mineral layer (A-horizon) soils were extracted using 0.5M ammonium acetate solution to approximate natural cation availability. At Buck Creek, nickel availability in A-horizon soils varied little over the year. Nickel in O-horizon samples was generally lower, except during February when a peak of nickel availability was observed, possibly representing nickel release from decaying leaf litter. Elevated nickel in stream water was detected in April, suggesting nickel movement from soil to surface waters. In the dry tropical forest at Susúa, O-horizon soils had consistently lower nickel concentrations than A-horizon soils, with little seasonal variation. In the humid tropical forest at Maricao, there were no significant differences either between collection dates or soil horizons. All water samples from Puerto Rico were below detectable limits for nickel. These findings suggest that the more dramatic weather changes and more strongly deciduous vegetation in North Carolina cause consequently greater seasonal variability in nickel movement in temperate forests.

Plant Ecology II

- 24 MICHOT, ALLEN, III¹, CHRISTOPHER A. ADAMS², AND RICCARDO FIORILLO³. University of West Georgia¹, Shorter College², and University of Louisiana – Monroe³—Seed germination of ecology of common cocklebur, *Xanthium strumarium* (Asteraceae), a weedy species with dimorphic seeds.

The purpose of this study was to determine if there are significant differences in the germination ecology of the dimorphic seeds found in common cocklebur, *Xanthium strumarium*. In August 2004, fruits were collected from a population of *X. strumarium* found in a dry seasonal pond in Marshall Forest located in Rome, GA. *Xanthium strumarium* produces fruits containing two dimorphic seeds. Two-hundred fruits were weighed; then seeds were removed and weighed. Seeds from each fruit were separated according to size into a large or small phenotype group. For two months, 100 seeds of each phenotype (10 replicates of 10 seeds each) were subjected to a cold stratification treatment (over-wintering) and then moved to 25°C. The remaining 100 seeds in each phenotype group received no cold stratification and were maintained at 25°C in a growth chamber. A separate group of seeds were stored in a dry environment for a period of four months. Following this period of dry storage, seeds received the same treatments as described above: one group received cold stratification and the other was placed immediately at 25°C. Germination percentages were determined for seeds in all treatments. Also, 100 seeds of each phenotype were planted in a non-heated greenhouse in October 2004 and were kept there through May 2005. The germination phenology of these seeds was monitored as well. We present data on germination and growth rate.

- 25 HUGHES, NICOLE M. AND WILLIAM K. SMITH. Wake Forest University—When are red juvenile leaves mature enough to be green? The coordination of anthocyanin decline with photosynthetic maturity

Juvenile leaves commonly appear red due to anthocyanin pigments, which are gradually lost with leaf maturity. In the current study, anthocyanin presence and decline during leaf maturation were evaluated in three deciduous tree species to determine whether anthocyanin loss corresponded to development of photosynthetic maturity (i.e. chlorophyll content, lamina thickness, anatomical development, and photosynthetic CO₂ exchange).

Results showed that development of ~50% mature photopigment concentration, ~80% mature lamina thickness, and differentiation of the mesophyll into palisade and spongy layers corresponded with anthocyanin loss in all three species. Photosynthesis correlated positively with leaf thickness and chlorophyll concentration (per unit area), and negatively with anthocyanin concentration. Species with higher photosynthesis in younger leaves lost anthocyanin earliest in development. Chlorophyll *a/b* ratios increased as leaves matured, indicating a possible shading effect of anthocyanin. These results suggest that anthocyanins in younger leaves persist until light-processing and carbon-fixation capabilities have matured to adequately balance energy capture with utilization. This is consistent with the current hypothesis that anthocyanins function as light attenuators, preventing excessive photon damage in leaves vulnerable to high-light stress.

- 26 CIRTAIN, MARGARET C., SCOTT B. FRANKLIN AND S. REZA PEZESHKI. University of Memphis—*Arundinaria gigantea* light level response - field and laboratory studies.

The once dominant *Arundinaria gigantea* (Walt.) Muhl. canebrake ecosystem has been reduced to fragmented populations, trapped between increasing agricultural and urban development and encroaching closed canopy forests. This decline in the *A. gigantea* population has resulted in a critically endangered ecosystem, impacting many species and making reestablishment of canebrakes necessary for maintaining and enhancing biodiversity in the southeastern United States. The goal of this study was to gain a better understanding of the impact of light on *A. gigantea* growth by examining light effects in both field and laboratory studies. Thinning sites were established in existing cane populations and forest canopy reduced 60% by girdling overstory trees. Transects were established to monitor population growth for both control and treatment sites. A laboratory experiment was conducted to test light levels (partial shading and full light) and nitrogen (0, 0.5, 1.0, 25, and 100 g/L) effect on seedling growth. Additionally, a light response curve was conducted to examine plant light usage. Results from both field and laboratory studies indicate *A. gigantea* growth is enhanced with increased light levels. Reduction of overstory canopy is a potential management practice for increasing existing populations. In addition, increasing nitrogen to levels up to ten times the commercially recommended amount may significantly increase seedling growth with plants grown under full light conditions. Of particular interest is the observed increase in root and rhizome biomass, which could be critical for improving establishment and survival of plants to a restoration site.

- 27 WELCH, NICOLE TURRILL¹ AND DWAYNE E. COLEMAN². Middle Tennessee State University¹ and Lake Mead National Recreation Area²—Factors influencing *Pinus pungens* regeneration on Green Mountain, Cosby, Tennessee.

Many *Pinus pungens* populations on the southern Appalachian landscape contain older individuals and regenerating them with prescribed burning is difficult. A 2001 wildfire on Green Mountain, Cosby, Tennessee, resulted in excellent *P. pungens* regeneration. We examined factors that possibly influenced *P. pungens* regeneration on Green Mountain and hypothesized that *P. pungens* cover was negatively correlated with ground layer cover and positively correlated with *P. pungens* basal area. We measured basal area and density of canopy trees (> 10 cm dbh) and percent cover of ground layer species (≤1 m height) and collected two 10-cm soil samples within eight 100m² plots in July 2004. *Pinus virginiana*, *P. pungens*, *P. rigida* and *Nyssa sylvatica* dominated the pre-burn canopy. The majority of *P. pungens* were 20-30 cm dbh. Ground layer cover was 88.5±3.4%. *Erechtites hieracifolia*, Asteraceae, *Dichanthelium dichotomum* and *Conyza canadensis* were the most important herbaceous species and *P. pungens*, *Smilax glauca*, *Oxydendrum arboreum* and *Acer rubrum* were the most important woody species of the ground layer. *Pinus pungens* cover was negatively related to ground layer cover ($r=-0.57$,

$P=0.14$) and positively related to *P. pungens* basal area ($r=0.52$, $P=0.19$). Regression analysis using these two variables explained 44% of the variation in *P. pungens* cover. Canonical correspondence analysis revealed a negative association of *P. pungens* with *Vaccinium pallidum* and ground layer cover and a positive association with soil P and silt. Analysis of chloroplast and mitochondrial DNA variation is underway to estimate the number of seed trees that contributed to *P. pungens* regeneration.

- 28 LETT, CARLY AND LAURA E. DeWALD. Western Carolina University—Influence of mycorrhizal fungi on *Celastrus orbiculatus*.

Many exotic species have the ability to rapidly out compete native plants, leading to an overall decline in species richness and ecosystem function. Exotic species' interactions with mycorrhizae may differ from native species in a way that facilitates invasiveness. This study examined the effects of mycorrhizal fungi on the exotic invasive plant *Celastrus orbiculatus* to better understand the mechanisms that might allow for its rapid spread in a non-native environment. *C. orbiculatus* was grown for one year in soils with and without mycorrhizae and under low and optimum phosphorus treatments. Photosynthesis was measured during the growing season, and total height, leaf area, shoot and root dry weight and mycorrhizae infection were measured at the end of the experiment. Preliminary data analyses indicate that traits varied significantly among both phosphorus and mycorrhizae treatments but not all traits varied in the same direction. The results suggest that mycorrhizae generally have positive effects on the growth of *C. orbiculatus*. Implications of these results regarding evaluation of areas at greatest risk for invasive spread of *C. orbiculatus* and management strategies will be discussed.

- 29 HUDSON, SHARON, ZHIJUN LU, AND SCOTT FRANKLIN. University of Memphis—Is stolon connection disadvantageous to clonal growth of *Cynodon dactylon* under homogeneous environments?

Clonal plants exhibit modular growth in the form of repeating segments (ramets) that are connected via stolons or rhizomes and allow translocation of vital resources. Physiological integration may confer advantages through spatial division of labor when clonal plants encounter heterogeneous resource availability, but may also have consequences of increased within clone competition in relatively homogeneous environments. Within clone competition is not well documented. In this study, we used *Cynodon dactylon* (Bermuda grass), a stoloniferous species, to determine if physiological integration facilitates within clone competition when grown under homologous high and low (water stress) water availability. We applied two integration treatments (severed and intact) to pairs of ramets from eleven clones randomly assigned to either high (400ml/day) or low (150ml/day) water treatments. We found no significant effects of stolon condition on fresh weight, ramet length, internode length or root to shoot ratio. Total stolon length and number of new ramets was significantly greater under severed conditions in the high water treatment only. Production of plants grown under high water conditions was significantly higher for all variables measured. Stolon connection didn't significantly enhance the growth capacity of *C. dactylon* under water stress (low water), suggesting that connections between ramets do not necessarily enhance the growth capacity of *C. dactylon* under stressful environments. Stolon severing seemed to enhance the capacity for growth of *C. dactylon* by increasing number of ramets and total plant length. This may be due to a decrease in clone competition for parental resources.

- 30 DUVAL, WILLIAM L. AND REBECCA R. SHARITZ. University of Georgia—Clonal integration and disturbance in a woody shrub.

Integration, the sharing of resources among connected ramets, is a topic well-studied in clonal herbaceous plants. Studies of integration in their woody counter-parts, however,

lag behind severely. Thus, the study of clonal integration using woody plants is an important step towards understanding clonal plants as a whole. *Vaccinium stamineum*, or deerberry, is a common woody shrub whose primary means of reproduction is asexual. In the southeastern United States, this species grows in a fire-prone environment where disturbances are common, making response to disturbance an important aspect of its life cycle. We examined the effect of clonal integration on the survivorship and growth of *V. stamineum* under varying disturbance conditions. The experiment consisted of a gradient from small scale disturbances (twenty-five percent removal of ramets) to large scale disturbances (seventy-five percent removal). Examining the survivorship and growth of the clones allowed for a comparison of the advantages and disadvantages of integration. In addition, mapping of individual ramets within the clones of *V. stamineum*, both pre- and post-treatment, enabled a spatial analysis of the growth patterns. Integrated clones produced significantly more new ramets and greater vertical growth of ramets at all levels of disturbance than did non-integrated clones. At different time periods, however, the magnitude of the interaction between disturbance intensity and integration showed dissimilar patterns, while the significantly greater production in integrated clones was retained. The results of this study allow for a comparison of advantages and disadvantages of clonal integration between woody species and their herbaceous counterparts.

- 31 LUKEN, JAMES O. Coastal Carolina University—Performance of *Dionaea muscipula* as influenced by developing vegetation.

Demography, growth, and flowering of *Dionaea muscipula* (Venus' fly trap) were studied during three years (2003-2005) following prescribed fire. Data were collected in permanent quadrats where the developing vegetation was either repeatedly clipped or allowed to grow. Clipping increased light availability at the soil surface. Over the study period, seedling establishment and flowering declined with increasing time since the last prescribed burn. Seedling densities did not differ between clipped and control quadrats, although greater numbers of seedlings grew to adult size in control quadrats and this significantly influenced population size-class structure. Clipping had no effect on leaf number or senescence, but plants in control plots were larger and had marginally longer petioles. The plant populations initially mapped in 2003 showed a continuous decline throughout the study and this decline was punctuated by temporary senescence linked to drought conditions. Drought-induced senescence had a persistent influence on plant size. Relatively higher seedling recruitment to the adult population in control quadrats produced an overall population increase of 18% as compared to a 17% decline in the population from clipped quadrats. *Dionaea muscipula* may have limited ability to respond to increased light availability due to leaf development constraints and repeated drought-induced senescence. Fire-dependence may best be defined in terms of seedling establishment and stimulation of flowering. Consistent soil moisture is critical to *Dionaea muscipula* but the species has characteristics that allow persistence across a wide range of vegetation trajectories.

- 32 **CANCELED: PAPER NOW POSTER 98B**

Plant Systematics I

- 33 MCMULLEN, CONLEY K.¹, KRISTEN E. BAIRD², MICHAEL S. WOOLF¹ AND ANDREA WEEKS². James Madison University¹ and George Mason University²—Update on a taxonomic revision of the endemic members of *Cordia* (Boraginaceae) in the Galápagos Islands.

Presently, seven species of *Cordia* L. (Boraginaceae) are said to inhabit the Galápagos Islands. Four of these species are endemic (*C. anderssonii*, *C. leucophlyctis*, *C. revoluta*,

C. scouleri), whereas three are non-endemic (*C. alliodora*, *C. lutea*, *C. polycephala*). The endemics, all of which are members of *Cordia* sect. *Varronia* (P. Browne) Roemer & Schultes, are thought to have originated in the western (Andean) region of South America and arrived in the archipelago via long-distance dispersal by birds. Our ongoing collaborative project uses a variety of characters (morphological, molecular, palynological, and reproductive) in preparing a taxonomic revision of these endemics. Here we report our progress in using morphological characters and comparative DNA sequence analysis of the endemic species (49 accessions) to establish the number of *Cordia* lineages in the Galapagos and their distribution among the islands. This study will ultimately provide a clear understanding of species limits and relationships, and reliable records of species distributions.

34 SHAW, JOEY¹ AND RANDALL L. SMALL². The University of Tennessee-Chattanooga¹ and The University of Tennessee-Knoxville²—Hybridization, lineage sorting, and the problem of inferring phylogenies among closely related species.

Alfred Russel Wallace was among the first scientists to begin collecting variants of species from across their ranges and documenting their geographical relationships. At that time most scientists believed in archetypal species and collectors were really only interested in obtaining an exemplar of each. Wallace, however, gained insight into the variability that exists within many species, which played a role in forming his ideas regarding evolution. Following this same pattern, many plant molecular phylogeneticists continue to use single exemplar specimens to represent a species—even though it has been recognized for several years that intraspecific DNA sequence variation is common in higher plants. Using a single exemplar to represent the evolutionary history of an entire species in a DNA-based phylogenetic study is analogous to thinking of a single specimen as an archetypal representative of the species. In a survey of the literature we noted that most intrageneric phylogenetic studies have used the strategy of sampling one or few representatives per species. In sampling a single representative per species, one makes the following four assumptions: (1) the study species are monophyletic, (2) the study species are genetically and reproductively isolated, (3) the boundaries between the study species are well delineated, and (4) the exemplar specimens are accurately identified. In closely related groups of species, where one or more of these assumptions may be violated, sampling multiple individuals from each of the representative species is the only means of accurately assessing phylogenetic relationships, and may provide insight into patterns of hybridization/introgression, lineage sorting, and phylogeographic relationship.

35 GILLESPIE, EMILY L., CATHERINE M. BUSH AND KATHLEEN A. KRON. Wake Forest University—Phylogenetic relationships among major clades of Ericoideae (Ericaceae) based on multiple molecular markers.

The Ericoideae (formerly known as Rhododendroideae) are one of several subfamilies that comprise the Ericaceae. Previous research demonstrated that the group known as Rhododendroideae was paraphyletic and as a result was re-circumscribed to include the former Empetraceae and renamed to reflect the type, *Erica* (hence Ericoideae). Four groups are apparent within the Ericoideae and are generally recognized at the rank of tribe. These include Empetreae (*Empetrum* and *Ceratiola*), Rhodoreae (*Rhododendron*, *Menziesia* and *Therorhodion*), Ericae (*Erica*, *Calluna* and *Daboecia*) and Phyllodoceae (*Phyllodoce*, *Kalmiopsis*, *Epigaea*, *Rhodothamnus*, *Elliottia*, *Kalmia* and *Bejaria*). The Ericoideae are diverse with regard to several aspects of flower morphology (e.g. petal number, petal connation), leaf type (ericoid versus flat) and pollination strategy. Although in recent studies the monophyly of Ericoideae is well-supported, and although some subclades are also well-supported, relationships among tribes within the subfamily are not fully understood. Additionally, membership of some tribes (notably Phyllodoceae) differs

among analyses. For example, *Bejaria* is sometimes resolved separately from the remaining Phyllodoceae, as is a *Bryanthus/Ledothamnus* clade, a *Kalmia* clade and an *Elliottia* clade. Conversely, some analyses have placed *Diplarche* (Rhodoreae) within Phyllodoceae. The objective of the present study is to resolve relationships among the major ericoid tribes. The study includes several molecular markers, including *ndhF*, *nrlTS*, *matK*, *waxy* (GBSS-1) and *LEAFY*. Of particular interest is the uncertain membership of Phyllodoceae. Resolution of major clades within the Ericoideae will be followed by an examination of the Phyllodoceae at a finer scale.

- 36 BUSH, CATHERINE AND KATHLEEN KRON. Wake Forest University—The phylogeny, morphology and biogeography of the wintergreen group (Gaultherieae; Vaccinioideae; Ericaceae; Ericales).

The monophyletic wintergreen group (Gaultherieae) is composed of five genera: *Chamaedaphne*, *Diplycosia*, *Gaultheria*, *Leucothoe* and *Tepuia*. The group exhibits unusual geographical distributions including a monotypic North American/European genus (*Chamaedaphne*), a small genus found only on the tepuis of Venezuela (*Tepuia*) and one large genus whose most species-rich region spans southwest China and the Himalayas (*Gaultheria*). Of great interest is the definition of synapomorphies for clades within the group as well as the variation exhibited in these characteristics. For instance, the approximately 100 species of *Diplycosia* are found only in Southeast Asia and are considered to be distinct from *Gaultheria* due to their predominantly epiphytic habit. Both genera share the traditionally important character of a dry/indehiscent capsule with a fleshy calyx (though the degree of fleshiness often determines generic limits within *Gaultheria*). To explore these unique aspects of the wintergreen group, *ndhF*, *matK* and ITS sequences were generated for representatives of each genus. These preliminary results confirm the monophyly of the group as a whole and also offer strong support for the monophyly of a surprising subset of three genera: *Tepuia*, *Diplycosia* and *Gaultheria*. *Tepuia* is shown to be deeply imbedded within the predominantly *Gaultheria* clade and *Diplycosia* is a well supported clade that is derived from within *Gaultheria*. Several strongly supported clades are recognized that correlate well with geographic areas including those from South America as well as the Himalayas/Southeast Asia. Based on the taxon sampling in this study, calyx fleshiness appears to be phylogenetically informative within *Gaultheria*.

- 37 ROBERTS, ROLAND P., PIERRE G. DAZÉ, HELEN NAYLOR AND DANIEL SARVAIDEO. Towson University—Unraveling evolutionary relationships within subtribe Solidagininae: two genomes, multiple genes, phylogenetic signal and incongruence.

Hypotheses of evolutionary relationships among species within subtribe Solidagininae, to date, have been based on analyses of morphology, anatomy, chloroplast restriction site data, and DNA sequences of nuclear ribosomal genes. These analyses have assisted in defining major groupings of genera within the subtribe but offered little resolution among species within genera. Here we explored the utility of several nuclear and chloroplast genes for evaluating evolutionary relationships among species of the subtribe. Varying degrees of success were achieved with amplification and sequencing of both nuclear and chloroplast genes. Some primers yielded no amplicons while others produced an array of artifacts indicative of non-specific priming. Primers that consistently amplified a single product were applied across 22 genera representing over 40 species of Solidagininae. Phylogenetic analysis revealed inconsistent signal across datasets. As a result, datasets with compatible signal, evaluated using the partition homogeneity test, were combined for phylogenetic analysis. Subsequently, trees were evaluated for common lineages with strong statistical support. In addition, a total evidence approach was taken using data partitions and Bayesian phylogenetic inference. This approach facilitated the application of

specific models of evolution to each data partition rather than averaging one model across the entire data set. The results of this study offers promise for resolving infrageneric relationships in subtribe Solidagininae and may be applicable to other difficult groups of Asteraceae.

- 38 VALENTE, MATTHEW J. University of Tennessee-Knoxville—Clonality and patterns of genetic diversity revealed by AFLPs in *Schisandra glabra* (Brickell) Rheder (Schisandraceae), a threatened woody vine.

Schisandra glabra (Schisandraceae) is a rare woody vine occurring throughout the southeastern United States and in a disjunct population in central Mexico. Despite its wide historical distribution from the coastal Carolinas, Georgia Piedmont, Blufflands of the Mississippi River, to cloud forest in Hidalgo, Mexico, *S. glabra* is considered threatened or endangered in all jurisdictions. Many “populations” (e.g. the single collection from Kentucky) consist of a single contiguous patch that flowers infrequently. Additionally, several historical populations, including those in the coastal counties of South Carolina, and several around Atlanta, Georgia, appear to have been extirpated by anthropogenic habitat destruction, to which *S. glabra* is especially sensitive. The goal of this study is to assess clonality, evaluate population structure and genetic diversity within and among populations, and test hypotheses regarding the evolutionary history and disjunct distribution of *S. glabra* using amplified fragment length polymorphism data (AFLPs). Preliminary data indicates significant genetic structure between populations of *S. glabra* in the Southeast and Mexico and that asexually reproduction via clones is common for the species.

- 39 ROLLINS, DOLLIE L.¹, CATHERINE M. BUSH² AND GERALD L. SMITH¹. High Point University¹ and Wake Forest University²—A cladistic analysis of the southeastern U.S. species of *Hymenocallis*.

A cladistic analysis using morphological, cytological and ISSR data was performed on the fifteen recognized southeastern U.S. species of *Hymenocallis*, as well as *Pancratium maritimum* as the outgroup. In 1962, Hamilton Traub determined six alliances within the genus. Three of these alliances are represented in the fifteen species analyzed in this phylogenetic study. It was determined that *H. latifolia* is sister to all other *Hymenocallis* species. *Hymenocallis occidentalis* and *H. choctawensis* were found to be sister taxa, as were *H. henryae* and *H. palmeri*. *Hymenocallis rotata*, *H. godfreyi* and *H. tridentata* were found to be closely related. Additionally, *Hymenocallis duvalensis* was found to be sister to a clade comprised of *H. crassifolia* and *H. pygmaea*. A monophyletic Henryae alliance and a paraphyletic Caroliniana alliance are supported.

- 40 VANDERVORT-SNEED, JOY AND ZACK MURRELL. Appalachian State University—Molecular differences used to support morphologically and ecologically delineated species boundaries of two imperiled wild gingers (*Asarum contracta* and *Asarum rhombiformis*).

Asarum contracta is considered endangered in NC and *Asarum rhombiformis* has just been elevated to threatened status in NC. *Asarum contracta* and *A. rhombiformis* are considered sister taxa in one unresolved species complex in the genus *Asarum*. The lack of taxonomic resolution is in part due to the wide range of variation in flower and leaf construction within the genus. Therefore, there are questions over whether the floral differences between *A. contracta* and *A. rhombiformis* are merely variations, or if they are indications that the taxa are distinct. The LEAFY gene, which is involved with development of flowers, was the source of molecular information used to elucidate phylogenetic relationships between the two imperiled wild gingers (*A. contracta* and *A. rhombiformis*.) Due to the apparent closeness of relationships between *A. contracta* and

A. rhombiformis, a small number of nucleotide differences were assumed to be enough support if this is in agreement with ecological and morphological data delineating species boundaries. The LEAFY gene was cloned to determine if there are multiple copies in the nuclear genome, and preliminary data suggest that at least two copies exist. In addition to the molecular analysis, co-occurring species were recorded for 8 populations of *A. rhombiformis* and 3 populations of *A. contracta* using the North Carolina Vegetation Survey methodology. Morphometric data were also gathered to examine the floral variation in the group. Information obtained from this study will help in the drafting of any future conservation plans designed to protect the currently two imperiled species.

- 41 NIEDENBERGER, BRYAN A.¹ GERALD L. SMITH² AND RAYMOND O. FLAGG³. Appalachian State University¹, High Point University² and Carolina Biological Supply Company³—Taxonomic intrigue in the copper rain-lily complex.

Habranthus Herb. *Habranthus* is a poorly known amaryllid genus centered in the Neotropics. It is sister to *Zephyranthes* Herb. and differs from it by zygomorphic flowers and arcuate anthers on filaments of more than two lengths. *Habranthus tubispathus* (L'Her.) Traub, the copper rain-lily, is native to southern Brazil and sympatric with *H. tubispathus* var. *roseus* in Uruguay and Argentina. Interestingly, *H. tubispathus* is disjunct in Texas, Louisiana and Alabama. Our study of typical *H. tubispathus* and var. *roseus* in the W. S. Flory living Amaryllidaceae collection revealed intriguing surprises. We observed that the typical copper rain-lily exists in two color forms. Both have yellow-orange perianth segments, but one has a maroon central basal area and the other has a green central basal area. Each color form also sets a distinctive capsule. Maroon-basal-area flowers set a uniformly green, elongated capsule, while green-basal-area flowers set a subglobose capsule with dark and light green stripes – appearing as a miniature “watermelon.” Adding to the intrigue is var. *roseus* having light rose tepals with dark purple veins and setting a third capsule type which is uniformly green and broadly triangular. All three variants of *H. tubispathus* are $2n=24$, but each has a distinct karyotype. To better understand relationships, foliar flavonoids were extracted for *H. tubispathus* variants as well as several other South American *Habranthus* species. The profiles were analyzed by Neighbor Joining in PAUP. A primary goal of our *Habranthus* studies is to determine the taxonomic status for variants of *Habranthus tubispathus*.

- 42 SCHUSTER, TANJA M. AND KATHLEEN A. KRON. Wake Forest University—Diversification of *Erica* L. (Ericaceae) in South Africa's Cape Province.

Erica L., is the largest genus in Ericaceae and in the flora of Southern Africa. The center of diversity of *Erica* L. lies in the southern Cape Province; only 76 of the 860 recognized species are found in the remainder of Africa, Europe, and the Middle East. Previous molecular studies indicate that the South African species are derived relative to the European species. In this study molecular analyses of data from the nuclear genome (*leafy* and *rpb2*) are employed to investigate monophyly and resolution of intrageneric relationships in *Erica*. Parsimony analyses of sequence data from 69 species of *Erica* from the southern Cape differing in pollination syndrome, flower morphology, geographical distribution, and soil preferences are carried out. Sampled taxa include indehiscent and dehiscent fruit morphology because fruit type has been a factor for exclusion of the previous “minor” genera out of *Erica* L. Species sampling for this study was done to represent the most recent classification including 41 sections. Results of our analyses indicate that indehiscence as well as bird pollination has likely arisen multiple times within the group.

- 43 WEEKS, ANDREA. George Mason University—Phylogenetic systematics and historical biogeography of southern African *Commiphora* (Burseraceae).

Commiphora (myrrh; Burseraceae) is a widespread and species-rich African tree genus (ca. 130 African species) that specializes in seasonally dry to desert-like ecological conditions. As such, it is a model taxon for understanding the floristic development of the arid, (sub-) tropical flora of Africa over geological time. Developing a comprehensive molecular phylogeny of the genus will help us understand its historical biogeography, as well as focus future taxonomic revisions on smaller, more tractable lineages of species. Preliminary studies have revealed that at least some morphological characters used to circumscribe taxonomic sections have evolved multiple times, probably in response to selection for water conservation, and are not reliable indicators of genetic relationship. Here we report the phylogenetic placement of endemic Namibian species and those with more widespread distribution in southwestern Africa using comparative analysis of DNA sequence data. Namibia contains geographically distinct regions of endemism for *Commiphora* species, and 15 of 29 species (52%) are unique to this country. We expect to test the timing of species divergences with fossil-based calibration of the molecular data, reconstruct distributions of common ancestors, and identify morphological synapomorphies that best distinguish major clades of species.

Genetics, Cellular and Molecular Biology I

44 CANCELED

45 BUCHER, ASHLEY, JACOB BRAY AND ZAFER HATAHET. Northwestern State University—Base excision repair genes in *E. coli* regulated by the ArcAB two component signal transduction system.

Repair of DNA damage is a key cellular function responsible for the maintenance of genomic integrity. Oxidative damage is of particular interest since it is largely a byproduct of metabolism. In all known organisms, several enzymes work together to remove oxidative lesions, through the process of base excision repair (BER). Transcriptional regulation of BER genes in bacteria is still poorly understood. We have recently discovered that expression of the BER genes *nth*, *nei*, *fpg*, and *mutY* is controlled by the ArcAB signal transduction pathway, a premiere regulator of the redox state in *E. coli*. We have constructed single and double deletion mutants of BER genes and either *ArcA* or *ArcB* and analyzed their mutation frequency. We report significant effects of deleting either the sensor kinase gene (*ArcB*) or the transcription factor (*ArcA*) on all four BER genes. We have recently extended our research to study the specific binding sites of *ArcA* (called *ArcA* boxes), which are found in the promoters of over 300 genes in *E. coli*. Computer searches have been done to identify putative *ArcA* boxes in the promoters of the *nth* (five putative boxes), *nei* (four putative boxes), and *mutY* (one putative box) genes. The goal of this project is to confirm which *ArcA* boxes do actually bind the active transcription factor and what the relative affinity of binding to each box is. This should provide us with valuable insights into the mechanism by which *ArcA* regulates the expression of BER genes.

46 TALLEY, JENNELL M., MARGARET H. PLATTS AND KATHERINE L. FRIEDMAN. Vanderbilt University—Using partial proteolysis to investigate structural domains within Est3p.

Telomerase is a ribonucleoprotein complex that extends the ends of most linear, eukaryotic chromosomes. It is made up, minimally, of four components, Est1p, Est2p, Est3p and TLC1-RNA. Est2p combined with TLC1-RNA make up the catalytic core of the telomerase complex and are the only components needed for *in vitro* telomerase activity. Est1p and Est3p are essential regulatory proteins that are necessary for *in vivo* telomerase function, but are dispensable *in vitro*. Gaining insight into the functions and/or activities of these regulatory proteins is of great interest to our lab. Recent investigations

in our lab suggest that Est3p consists of three functionally conserved domains. These domains are required for at least two functions, Est3p assembly into and "activation" of the telomerase complex. Given that structure and function tend to be inter-related, I hypothesized that these three functionally conserved domains may also fold into three structurally distinct domains. To investigate this hypothesis I have purified His-Est3p and performed partial proteolysis on the protein. Since the protease is used at limiting concentrations, residues of Est3p that lie within unstructured regions are more likely to be cleaved than those in structured domains. Thus, by determining where cleavage events occur I can determine if the three functionally conserved domains also appear to be structural domains. To date, I have determined that the N-terminal functional domain appears to also be a structural domain.

- 47 DOZIER, UVETTA AND HEMAYET ULLAH. Howard University—Isolation of receptor for activated C kinase interacting proteins in *Arabidopsis thaliana* using the split ubiquitin assay.

Plants encounter a combination of environmental stress conditions and to response, they often utilize overlapping signaling pathways. In this regard, scaffold proteins are uniquely poised to integrate signals from multiple pathways by bringing interacting signaling components to proximity. Scaffold protein RACK1 in metazoan mediates diverse signaling pathways and is reported to interact with more than 70 diverse proteins. Loss-of-function alleles of *rack1a* in *Arabidopsis* implicate the protein in environmental stress signaling pathway. In an effort to identify the signal pathways RACK1 is involved with, we have screened an *Arabidopsis* split-ubiquitin ready cDNA library from inflorescence tissues to isolate RACK1 interacting proteins. Proof of concept screen successfully identified several putative interacting clones in photorespiration and UV-B stress response pathways. The interactions are confirmed by one-to-one bait-prey split-ubiquitin assay and by co-immunoprecipitation methods. It is proposed that by Homo/ heterodimerization and/or interacting with proteins in diverse stress response pathways, RACK1 proteins in *Arabidopsis* regulate diverse environmental stress signaling pathways.

- 48 HIGGINS, REBECCA C. AND ROOPA YALAMANCHILI. University of South Carolina-Columbia—Characterization of MAP kinase kinases involved in stress signaling in tomato.

Plants must defend themselves against a plethora of biotic and abiotic stressors. In order for a plant to synthesize appropriate defense compounds, there must be signal specific molecular events that vary between stressors. Stress signaling in plants involves activation of a Mitogen activated protein kinase (MAPK) cascade. In tomato, *Lycopersicon esculentum* MAPK1 (LeMPK1), LeMPK2, and LeMPK3 (as well as orthologs in other species) are activated in response to most forms of stress, with varying activation kinetics. The *Arabidopsis* genome project has revealed about 20 MAPKs, 10 MAPK kinases, and 60 MAPKK kinases. The MAPKKs function as convergence points for multiple stress signaling pathways. In order to determine which MAPKKs interact with the stress responsive LeMPKs 1, 2, and 3, we have employed a protoplast transient gene expression system in tomato. We have cloned four MAPKKs (based on homology to stress responsive MAPKKs in tobacco and *Arabidopsis*), LeMCK1, LeMCK2, LeMCK3, and LeMCK4. By transforming tomato protoplasts with constitutively active mutants of these MAPKKs, we can determine the downstream interactions with LeMPKs. Expression of LeMCK2 resulted in increased activity of LeMPKs 1, 2, and 3, whereas LeMCK4 resulted in increased activity of LeMPKs 1 and 2. Expression of LeMCK1 and LeMCK3 did not activate LeMPKs. We are currently testing the MAPKK-MAPK interactions in protoplasts in response to various elicitors of defense response, specifically, elicitors that activate LeMPK1/2. Protoplasts are treated with systemin and oligosaccharide elicitors to

stimulate the wound response, with UV-B radiation to stimulate the oxidative stress response, and with fusicoccin to stimulate the pathogen response.

49 **CANCELED: SEE TRI-BETA POSTER SESSION**

50 AGUIRRE, KAREN^{1,2}, CHRISTINE WARD¹ AND SHERRY PITTMAN¹. Coastal Carolina University¹ and Trudeau Institute²—Pathogen-specific CD8⁺ T cells secrete IFN- γ to activate brain-derived macrophages to produce pro-inflammatory cytokines IL6 and MIP-1 β .

Cryptococcus neoformans is a facultative intracellular pathogen. In the absence of a functional CD4⁺ T cell compartment, cryptococci colonize the central nervous system, causing lethal meningoencephalitis. We have shown that protective lymphocyte-mediated immunity to *C. neoformans* was established in mice that lacked CD4⁺ T cells and also effective B cell memory, by vaccination with a non-lethal dose of replicating organisms, provided the challenge dose was low. This suggests that *C. neoformans*-specific CD8⁺ T cells mediate anti-microbial effects in the central nervous system. CD8⁺ T cells are thought to act via a cytotoxic mechanism in the CNS, but studies have been carried out exclusively in viral systems, where host cell metabolism is significantly compromised. Microglia bearing non-viral intracellular pathogens like *C. neoformans* conceivably deploy defensive mechanisms not available to virally-infected cells. When *C. neoformans*-specific CD8⁺ T cells harvested from the brains of immunized and re-challenged mice were co-cultured with murine microglial cells, IFN- γ was elicited from the T cells, and microglial production of MIP-1 α and IL6 was induced. IL16 levels were also elevated in co-culture supernatants. CD8⁺ T cell-mediated toxicity was not detected. Thus, CD8⁺ T cells and microglia collaborated to mount an immune response more reminiscent of CD4⁺ T cell potentiation of macrophages than the CD8⁺ T cell cytotoxicity seen in viral systems. To our knowledge, this is the first exploration of CD8⁺ T cell/microglial interactions with an intracellular eukaryotic pathogen. These studies may inform attempts to construct a CD8⁺ T cell-based vaccine of value to CD4⁺ T cell-deficient individuals.

Animal Ecology I

51 OWENS, KATHLEEN M.¹ AND CHRISTOPHER B. MOWRY². University of Tennessee-Chattanooga¹ and Berry College²—Seasonal dietary composition of the eastern coyote (*Canis latrans*) in northwestern Georgia.

Coyotes (*Canis latrans*) have progressively colonized eastern North America following wolf extirpation and the clearing of forested landscapes. The coyote has expanded its geographic range into Georgia during the past 50 years, and its impact as the top predator is potentially influencing community dynamics via competition and/or predation. Few studies have examined coyote food habits in the southeastern United States. Our objective was to determine prey items consumed by free-ranging coyotes living on Berry College lands in northwestern Georgia. One hundred and twenty-seven coyote scats were collected from May 2005 through August 2006 along seven major service roads that transected the 28.55 mi² study area, and 270 prey items were identified. The four most frequently occurring prey items were Muridae rodents (26.3%), eastern cottontail rabbits (15.2%), white-tailed deer (13.7%), and eastern gray squirrels (10%). Fawn remains were slightly more frequent in coyote scats than adult deer (7.8% vs. 5.9%). Mammal remains (71.2%) comprised the largest prey category, followed by vegetation (10.7%), arthropods (7.4%), birds (3.3%), and reptiles (1.5%). Significant seasonal fluctuations of prey items/prey classes were found (P<0.0001). Rodents were most common in spring, vegetation (predominantly persimmons) occurred most frequently in fall, and arthropod consumption (predominantly grasshoppers) was constant throughout the year except during winter months. Prey classes Artiodactyla and Lagomorpha were consumed year

round, although fawns were an important prey item only in spring and summer months and eastern cottontails were most popular in the winter.

- 52 PORTER, S.¹, T. REDDING¹, B. MILLER¹, M. ROWE¹, M. SCHAUS¹ AND B. DONALDSON². Virginia Wesleyan College¹ and Virginia Department of Transportation²—Use of a designed highway undercrossing by wildlife.

In November 2005, the Virginia Department of Transportation opened a newly constructed section of Route 17, just east of Great Dismal Swamp NWR. In order to avoid impacts to a wetland and facilitate safe wildlife movement beneath the road, VDOT constructed a 984-ft long bridge. Twelve miles of fencing were constructed adjacent to the bridge, intended to funnel wildlife toward the bridge and minimize animal-vehicle collisions. This study entails the use of remote infrared wildlife cameras to study the effectiveness of this undercrossing at facilitating wildlife movement between the Great Dismal Swamp and habitats along the Northwest River Corridor to the east. During its first year of use, we documented an average of 22 wildlife observations per month at the north and south ends of the bridge. Mammal observations included White-tailed Deer (36%), Raccoon (30%), Opossum (7%), Bobcat (5%), Rabbit (1%), Squirrel (1%), and Red Fox (0.5%), but not black bear. We observed significantly more wildlife in raised and mulched dry crossing areas, as opposed to adjacent wet crossing areas. Deer and opossum observations varied substantially from month to month, but raccoon and bobcat showed distinct seasonal patterns with highest crossings during early spring, and with raccoon also active during late summer and early fall. Night observations were significantly higher for deer, raccoon, and opossum, whereas bobcat showed no preferred time of day for movement. We hypothesize that the use of this structure will increase over time, and we will continue to monitor its use at least through Nov. 2007.

- 53 MARBERT, BRYAN S. AND RAY S. WILLIAMS. Appalachian State University—Long-term precipitation alteration affects ground beetle (Family Carabidae) community structure in an intact hardwood forest.

Climate change is predicted to potentially alter terrestrial ecosystems via combined effects of warming and precipitation alteration. To date, precipitation has been altered 5% to 20% in various regions of the US. To investigate effects of altered precipitation on important ground-dwelling arthropod communities, in May 2005 we established 10 8 X 8 m plots in each dry, ambient, and wet treatment plots previously established at the Oak Ridge National Laboratory Throughfall Displacement Experiment (TDE). Ground beetles (Family Carabidae) were collected using pitfall traps during spring, summer, and fall and identified to tribe level. During the same periods microarthropods (mites) were collected through litter core samples and identified to suborder. Leaf litter samples were collected and litter temperature measured to assess chemical and physical attributes of the forest floor. Nine carabid tribes were collected, with abundance varying depending upon the collection date. Season proved to be an important determining factor for beetle community composition, with significant differences ($p < .05$) between sample periods observed, especially greater abundance, richness, and Shannon-Wiener diversity (H') during the summer. Trends of increasing abundance, (H'), and richness were observed in the wet treatment due to moisture additions, although all variables were not significantly different. Abundance, H' , and richness decreased in the dry treatment in the summer, while evenness significantly increased. Multiple regression analysis indicated that numerous abiotic variables, including litter temperature, C/N ratio and mass significantly predicted carabid abundance, richness, and H' . Our data demonstrates that precipitation alteration may significantly impact ground-dwelling communities in forests.

- 54 WELLS, CARRIE N., MARGARET D. HARRIS, JOHN QUATTROCCHI AND DAVID TONKYN. Clemson University.—Does climate drive range changes in the Diana Fritillary?

Butterflies are key organisms for monitoring biological diversity, and many northern species have been shown to shift their geographic ranges in response to global climate change. There have been no documented effects of global warming on butterflies in the southern Appalachian Mountains. However, even small temperature increases in this southern region can have dramatic effects on high elevation species that have nowhere to go. We are investigating the conservation status of the Diana fritillary, (*Speyeria diana*), a butterfly species of concern that has disappeared for unknown reasons from low elevations in the South-eastern United States. As the first part of this research, we collected over 1,500 records of this species' occurrence from 1896-2006 in order to document any shifts in range or phenology that have occurred over the past 110 years. Records were obtained from university and museum collections, state agencies, national parks, and private collectors. All location data were entered into a GIS and were mapped to the county level. We are next using these data to model future distributions of *S. diana* and members of its mimicry complex under predicted climate change scenarios to better manage and protect this species.

- 55 VILLALPANDO, SHAWN AND RAY S. WILLIAMS. Appalachian State University.—Elevated temperature affects insect community composition in an old-field ecosystem exposed to simultaneous climate change factors.

Climate change research has recently shifted to experiments that examine biotic responses to multiple factors (i.e. simultaneous [CO₂] and temperature exposure). As important is the recognition that more community-level investigations are needed in order to predict the effects of climate change on terrestrial ecosystems. The Old-Field Community Climate and Atmospheric Manipulation experiment at Oak Ridge National Lab, TN is examining an old-field plant community exposed to elevated temperature and [CO₂], along with reduced soil moisture. We characterized the insect community to address how multiple climate factors may affect insect community structure. Insects were sampled using a combination of sticky traps and vacuum sapling during the growing season of 2005. For the 152 morphospecies identified, elevated temperature significantly reduced cumulative morphospecies richness and evenness, while [CO₂] and soil moisture had no effect on insect diversity. Guild richness similarly decreased under elevated temperature, but was unaffected by [CO₂] or soil moisture. Our consistent insignificant CO₂ effect suggests herbivores were able to overcome observed increases in Carbon/Nitrogen ratios of *Solidago*, a dominant herb in our communities. This indicates no indirect effect of [CO₂] on richness or evenness within the insect community. Closer examination of our morphospecies data revealed that 39 morphospecies account for greater than 90% of the total abundance. We therefore conducted a rank order analysis and found 8 species, 2 herbivores, 3 predators, and 3 parasitoids, increased 200-300% in abundance at elevated temperature compared to ambient.

- 56 JONES, SIERRA J. AND DAVID S. WETHEY. University of South Carolina-Columbia.—Too hot to handle: experiments comparing the historic and present occurrence of *Mytilus edulis* at their southern limits.

While geographic distributions of species are influenced by climate, the range limits are believed to be set primarily by environmental temperature. In the Northern Hemisphere at the southern end of a species' range, organisms are living very close to their thermal tolerance limits. Because of this, small increases in thermal stress at these range limits can substantially decrease growth or survival. Therefore we expect global warming to cause a contraction of the southern limit. Researchers have proposed that intertidal

ecosystems will be among the first to display strong responses to changes in climatic conditions. We tested this idea with experimental manipulations of *Mytilus edulis*, an arctic-boreal, sessile invertebrate whose southern limit is historically at Cape Hatteras, NC. Transplant studies were conducted along a latitudinal gradient, from Guilford, CT to Beaufort, NC. Sublethal effects were analyzed as a measure of the stress of the organism, and survival counts were made throughout the duration of the experiment. Observations were made in 1960 of year-round survival north of Cape Hatteras, NC. Our results demonstrate that the historical southern limit of *M. edulis* is now a transient southern boundary, indicative of the effects of a warming climate on the range limits.

- 57 BRANNOCK, PAMELA M., DAVID S. WETHEY AND THOMAS J. HILBISH. University of South Carolina-Columbia—Monitoring the spread of a worldwide invader: the distribution of native and invading mussels in northern Japan.

The *Mytilus edulis* complex consists of three blue mussel species: *M. edulis*, *M. trossulus*, and *M. galloprovincialis*. These species are morphologically similar and can interbreed where they co-occur, thus molecular techniques are necessary to distinguish them. This complex provides an interesting system to study invasions because *M. galloprovincialis* has invaded numerous locations world wide, while the other two species have not been documented as invaders. In Japan around the mid 1900's *M. galloprovincialis* was introduced to an area endemic to *M. trossulus*. In 2004 and 2006 populations around the island of Hokkaido, Japan were surveyed to determine the current distribution of the two species. Populations were assayed utilizing nuclear loci. In 2004, results illustrated *M. galloprovincialis* dominates the western coast, while *M. trossulus* is found on the eastern portion of Hokkaido. In 2006 we sampled Hokkaido more intensively and expanded our survey into northern Honshu. Results illustrate the pattern of species distribution appears to be stable between these two sample years. Interestingly, the level of hybridization found in Hokkaido far exceeds that observed in other locations where the two species hybridize. Hybridization on the east coast of northern Honshu is present, but the level of hybridization is minimal compared to Hokkaido. Why these unprecedented levels of hybridization are found on the western coast of the Pacific Ocean but not the eastern coast requires further examination. In addition, the role aerial and water temperature may play in determining the distribution of these species requires further exploration.

- 58 WILLIAMS, RAY S. Appalachian State University—Will plants compensate for leaf loss in a future high [CO₂] world?- a field test.

The recognition that atmospheric [CO₂] continues a steady increase due to anthropogenic activity has resulted in many studies examining effects of elevated [CO₂] on terrestrial ecosystems. One approach has been to investigate potential impacts on plant-herbivorous insect associations. To date, few studies have investigated the potential for plants to overcome leaf area loss due to herbivores, as more CO₂ is available for carbon-fixation. To address this, I grew loblolly pine (*Pinus taeda*) seedlings at ambient and elevated [CO₂] (+300 ppm) and two levels of leaf loss (25% and 50%). Seedlings were grown from May-October, with leaf loss treatments initiated in August. Biomass gain was determined using both destructive and non-destructive techniques and the frequency of leaf flush development recorded. Elevated [CO₂] significantly increased above-ground biomass gain on every measuring date, while the negative effects of clipping were only observed up to six weeks after leaf clipping. After 84 days of growth with leaves removed, final biomass was significantly higher for stems and roots at an elevated [CO₂], while clipping had no effect. Similarly, the root:shoot ratio was significantly increased by [CO₂] enrichment but unaffected by clipping. An index of leaf flushing following clipping found significant enhancement of flush development due to enriched [CO₂] and clipping two-four weeks post clipping. Leaf area significantly increased at elevated [CO₂]. This study found a

greater response to [CO₂] enrichment than leaf area loss, possibly due in part to more allocation to growth in the face of leaf loss in this fast growing tree species.

59 **CANCELED: SEE TRI-BETA PAPER SESSION**

- 60 ALEXANDER, JEREMIAH R.¹, STEPHEN C. RICHTER¹, STEVEN J. PRICE² AND MICHAEL E. DORCAS². Eastern Kentucky University¹ and Davidson College²—Effects of urbanization and habitat fragmentation on spotted salamander (*Ambystoma maculatum*) populations.

With the U.S. population now over 300 million and growing at a record rate, the natural landscape is being reduced and fragmented. Reductions in habitable land threaten the genetic health of native wildlife. Such a loss in genetic diversity can negatively affect a population's ability to keep pace with long-term environmental changes, as well as short-term changes induced by humans. Genetic diversity can be measured in terms of differences in DNA composition. Microsatellites are short sequences of highly variable DNA, which makes them ideal markers for investigating overall genomic diversity within and among populations. Microsatellites, thus, can serve as molecular indicators of health, connectivity, and reproductive potential of populations. In this study, we chose five microsatellite loci to determine the effects of habitat fragmentation on a network of spotted salamander (*Ambystoma maculatum*) populations in the greater Charlotte, North Carolina area. We addressed two primary hypotheses: (1) degree of connectedness among populations across the fragmented landscape is inversely related to distances between populations and intensity of urbanization and (2) genetic variation within populations is inversely related to level of degradation of surrounding habitat. To address these hypotheses, we studied five populations of salamanders that varied in distance from nearest neighboring population and in quality of surrounding habitat. We used GIS to quantify habitat and distance variables. Results will be discussed in the context of habitat management, specifically the need for establishment of metapopulations such that multiple populations and breeding ponds are interconnected by contiguous habitat.

- 61 BLUE, JARROD¹, ELIZABETH J. BREWER¹, CHRISTOPHER CASTILLO¹, JUSTIN GOLDBERG¹, KATHERINE HAWKINS², TYLER KRENTZ AND CHRISTOPHER J. PARADISE¹. Davidson College¹ and Middlebury College²—Colonization and community dynamics in a simulated treehole metacommunity.

We used metacommunity theory to explain diversity in aquatic treeholes. A metacommunity is a set of local communities, such as treeholes in a forest, all linked by dispersal of component species. Treeholes have low patch similarity and insect larvae are subject to local factors within a patch, while adults disperse to other patches and are subject to regional factors. We predicted that the Species Sorting model, where species sort according to ability to survive in a patch type, and Mass Effects model, where patches become more similar due to high dispersal, would both partially explain diversity in treeholes. Our experiment consisted of a metacommunity made up of 16 mesocosms (patches) within the Davidson College Ecological Preserve. Mesocosms were deployed at one of three distances from any other known patch, and were one of two sizes, to create patch dissimilarity. Each week, water and leaf litter were extracted from each mesocosm and insect larvae were identified and counted. We repeated this weekly for ten weeks in summer 2006 and again for six weeks in fall 2006. As predicted by Species Sorting, several species were found primarily in one patch type, and communities tended to cluster by patch type rather than distance from known patches. However, we also found evidence for Mass Effects, as most species were not limited by dispersal distance, and towards the end of the experiment communities in different patch types became more similar. We conclude that treehole metacommunity dynamics are determined primarily by environmental variation between patch types.

THURSDAY, APRIL 19, 2007

AFTERNOON SESSION

Symposium II — A Symposium in Honor of Albert E. Radford (1918-2006): Contributions to Southeastern Botany, floristics, Ecology, and Conservation.

- 62 WEAKLEY, ALAN S. University of North Carolina-Chapel Hill—A remembrance of Albert E. Radford (1918-2006).

Albert E. Radford (1918-2006) was an extremely influential figure in southeastern botany, ecology, and conservation. He is probably most widely known as the author, with Harry E. Ahles and C. Ritchie Bell, of the *Manual of the Vascular Flora of the Carolinas*, a flora which has served as the primary floristic reference for much of the Southeastern and Mid-Atlantic United States (well beyond its 2-state coverage) for nearly 40 years. Published in 1968, it set a new standard in eastern North America, based on extensive collecting, and with careful technical descriptions, good keys, extensive line drawings, and county distributional information for all taxa. Radford is also remembered for his role in training generations of academic and agency botanists who went on to their own influential careers. His students learned the rich Southeastern flora, the associations between species, communities, and substrates, and the wonders of special natural areas across the region, through his teaching in the classroom and, especially, on whirlwind field trips to remarkable natural areas of the Southeast. His Ecosystematics course taught budding scientists to “cerebrate” over the interconnections between the flora, plant communities, geology, soils, climate, hydrology, topography, and physiography. In the 1970s, Radford became increasingly concerned over the regional loss of biodiversity, and he became an influential advisor to The Nature Conservancy and governmental agencies, leading to the conservation of numerous natural areas – perhaps his most lasting and important legacy.

63 CANCELED

- 64 MATHEWS, KATHERINE G. Western Carolina University—Systematics and biogeography of *Sabatia* (Gentianaceae).

Sabatia is a genus of 18 species of herbs found in eastern North America, Mexico & the Caribbean. Most of the species occur on the Atlantic and Gulf coastal plains of the southeastern U.S., and four are endemic to the coastal plain. Most prefer wetland habitats. *Sabatia* contains white and pink-flowered species, five-merous and polymeric species, and protandrous outcrossing and autogamous species. The species display a wide range of chromosome numbers. The evolution of floral traits and patterns of speciation in *Sabatia* were studied by reconstructing the phylogenetic history of the group using DNA sequence data from one nuclear and three chloroplast marker regions, comprising a total of 3,985 base-pairs. These data establish five well-supported clades within *Sabatia*, although relationships among these clades are poorly resolved. Geographical separation and ecological specialization appear to have been major factors in speciation, along with chromosome aneuploidy and polyploidy. Floral polymery likely evolved only once in the genus. *Sabatia calycina* is a self-fertilizing, polyploid species that may be of hybrid origin. *Sabatia campestris*, an Ozarkian species, is basal in the group, indicating an origin for *Sabatia* in the western uplands followed by migration to the coastal plain.

- 65 SORRIE, BRUCE A. University of North Carolina-Chapel Hill and North Carolina Natural Heritage Program—Identification, distribution, and habitat of needle-leaved species of *Hypericum* (Hypericaceae).

The nine species of needle-leaved St. John's-worts of the genus *Hypericum* (Hypericaceae) have confounded botanists and ecologists for three centuries. In 1962 species limits and ranges were relatively well worked out, but field and herbarium workers continue to experience difficulty with the group, and floras and manuals perpetuate errors and mis-statements. In this paper I present new and/or improved information on identification, accurate range maps based on verified specimens, and detailed information on habitats based on original field work.

- 66 ALLISON, JAMES R. Rutledge, Georgia—*Hypericum radfordiorum* sp. nov., an endemic species of the Brushy Mountains of North Carolina.

Hypericum radfordiorum Weakley ex J.R. Allison, sp. nov., endemic to granitic outcrops in or near the Brushy Mountains (upper Piedmont of North Carolina), commemorates the contributions to the knowledge and protection of the flora of the Carolinas and other states of the Southeast by two North Carolina botanists. *Hypericum radfordiorum*, known from ten sites, is distinguished from the related *H. virgatum* Lam. (*H. acutifolium* Ell.) by its more acuminate and distinctly longer leaves (longest usually more than 3 cm), and its often multiple and always copiously glandular stems, usually with several to many axillary flowering branches bearing moderately reduced leaves (longer than their internodes). Laurie Stewart Radford was among the first to collect it (in Wilkes County), in 1940, the year before her marriage to the late Albert E. Radford. Al Radford collected it from three other outcrops (in Alexander County), and these two counties remain the extent of its known range. The Brushy Mountain region includes a series of floristically interesting granitic ridges and nearby isolated domes in the upper western Piedmont of North Carolina. The botanically best known site is Rocky Face Mountain (Alexander County), whose floristics and plant succession were described by Catherine Keever et al. in 1951. Nearly endemic to these mountains is a moss named for Keever in 1956, *Orthotrichum keeverae* Crum & Anderson. The Brushy Mountain area is perhaps most famous botanically for one of Al Radford's remarkable discoveries, *Pellaea wrightiana* Hook., disjunct from Texas by ca. 1400 km.

- 67 WEAKLEY, ALAN S. University of North Carolina-Chapel Hill—A new flora for the Carolinas, Virginia, Georgia, and adjacent areas.

A new flora is being written, covering the Carolinas, Virginia, Georgia, and adjacent areas. The main flora currently in use in this area, Radford, Ahles, and Bell's 1968 *Manual of the Vascular Flora of the Carolinas* (RAB) has become seriously dated, with nearly 1000 additional taxa recognized for the Carolinas, the additional taxa resulting from the documentation of additional alien species naturalized in the region, additional native species being located in the Carolinas in recent decades, new taxa being named, and a net increase in splitting relative to taxonomic treatments prevalent in the 1980s. In addition, numerous additional name changes affect the list of taxa recognized, resulting from generic changes, promotion or demotion in taxonomic rank, nomenclatural changes, and other causes. The new flora differs significantly in format from RAB, lacking technical descriptions, but with substantial additional information on nativity, habitat, range-wide distribution, rarity, over 2000 taxonomic references, discussion of taxonomic concepts and issues, and extensive synonymy to regional floras and monographs and revisions. The keys are more detailed and emphasize vegetative characteristics, ecology, and geography to assist the field worker. Prior to formal publication the new flora is available online and in hardcopy from the University of North Carolina Herbarium; its widespread use in draft form has provided for pre-publication review, correction of errors and omissions, and steady improvement in keys and information content.

- 68 LUDWIG, J. CHRISTOPHER, ALAN S. WEAKLEY AND JOHN F. TOWNSEND. The *Flora of Virginia* Project—A new flora for the Old Dominion: a progress report.

In 2001, The Foundation of the Flora of Virginia Project was incorporated to promote and provide a funding infrastructure for the completion of a full, modern, illustrated *Flora of Virginia*. The *Flora* will include introductory chapters, keys, and descriptions of Virginia's full vascular flora, approximately 201 families, 1050 genera, and 3800 taxa. Virginia-specific keys, based on Weakley's larger *Flora of the Carolinas, Virginia, Georgia, and surrounding areas*, are completed for 101 of the families and underway for the remaining. Descriptions, based on literature and herbarium research, are completed for approximately 600 taxa and underway for over 2600. No introductory chapters have been completed. Approximately 600 original illustrations have been completed. Over 70% of funding for the project has been donated or pledged.

- 69 MURRELL, ZACK E. AND DERICK POINDEXTER. Appalachian State University—The role of cyberinfrastructure in conservation and biogeography in the Southeast.

The World Wide Web (WWW) has changed science and, in turn, how conservation and biogeographical studies are conducted. The Semantic Web will further revolutionize science by building a mesh of information that will allow scientists to gather and analyze data in a more thorough fashion, while providing opportunities for information retrieval by the general public in complex and automated systems. These innovations can be utilized by development of "virtual communities" of scientists. This is modeled in SERNEC, the SouthEast Regional Network of Expertise and Collections. This network of herbarium curators provides an electronic database of herbarium specimen labels and images. As this database is built, it will be reviewed by the collective taxonomic expertise of this virtual community, which will result in an increasingly accurate portrayal of the biogeography of the region. The SERNEC virtual community includes information scientists, social scientists, educators, and artists, as well as taxonomic expertise of the region's curators. In the information age of the semantic web, real power comes in the development of "high quality" information. The high quality database developed by SERNEC will attract the attention of the public, government decision-makers, corporations and educators, increasing the value of curatorial expertise. As collaborations among taxonomists, educators and information scientists grow, and as innovations such as interactive keys and complex mapping of biotic and abiotic components of the landscape develop within this virtual community, we will provide complex information in intuitively understandable fashion to various user groups, and therefore stimulate interest in plant conservation and biogeography.

- 70 PEET, ROBERT K., ALAN S. WEAKLEY AND XIANHUA LIU. University of North Carolina-Chapel Hill—A floristic atlas for the Southeast that uses taxon concept relationships to integrate distribution data.

Compendia of county-level floristic distribution records for the Southeast are available from multiple sources including books, state- and national-level websites, and museum databases. Heretofore, no one has successfully integrated the distribution data from these divergent resources, in part because the various sources recognize taxa that differ in name, circumscription, or both. Application of taxon concepts can greatly improve integration of biological data collected at different times and places by different investigators following different taxonomic treatments, provided that the relationships between taxon concepts used by various authors are mapped. We have formally documented relationships of taxon concepts used in 11 major southeastern floras and multiple narrow treatments to the 6300 taxa recognized in Weakley's 2005 southeastern

regional flora. The resulting database of taxon relationships contains approximately 65,000 entries. This concept relationship database is used in a dynamic online floristic atlas of the southeastern US flora (<http://www.herbarium.unc.edu/seflora/>) to integrate and provide access to distributional, specimen, and ecological data from multiple sources. A novel attribute of this atlas is interpretation of records from published floristic and taxonomic works in the narrow sense intended by the author while interpreting museum specimens and other name-based identifications in terms of the broadest possible nominal (name-based) concept. Inevitably the integration of diverse concepts leads to ambiguities in assignment of a record to a currently recognized taxon concept. When a record is ambiguous, it is reported for each taxon concept to which it might apply, with the ambiguity clearly indicated.

- 71 WARE¹, DONNA M. E. AND GARY P. FLEMING². College of William and Mary¹ and Virginia Department of Conservation and Recreation²—Soil calcium and pH and distribution patterns of mountain plants disjunct to the Coastal Plain in Virginia.

About 75 species which for the most part are not obligate calciphiles in their primary range in the mountain / western Piedmont region of Virginia also occur in Coastal Plain counties with deep ravines where fossiliferous members of the Chesapeake group have been exposed during ravine formation. Three classes of disjunction are recognized: strongly, less strongly, and weakly, with roughly one-third of the species falling into each class. Sixty-five soil samples (35 ravine systems in 10 Coastal Plain counties) from ravine slopes and swampy ravine bottoms where mountain disjuncts occur had a mean Ca concentration of 3,325 ppm (712-11,575) and mean pH of 6.1 (vs. 22 typical upland coastal plain hardwood stands with mean Ca concentration of 211 ppm and mean pH of 4.2). All but a few Coastal Plain counties have had at least one in-depth floristic study. The *Digital Atlas of the Virginia Flora* shows 57 mountain disjuncts in James City Co.; Surry Co. is second with 41; York Co. is third with 28. The watershed of Grove Creek (James City Co.) has more mountain disjuncts than any other site studied. Northampton Co. has none and 8 other counties with overlay deposits, few ravines, or less study have 6 or fewer. All other counties (18) have a mean of 11.6 mountain disjuncts. Approximately 20% of the species with mountain to Coastal Plain disjunctions in Virginia also show that pattern in North Carolina and 10% in South Carolina.

- 72 GADDY, L. L. terra incognita—The status of pond cypress (*Taxodium ascendens*)-dominated wetlands associated with Canby's dropwort (*Oxypolis canbyi*) in North Carolina, South Carolina, and Georgia.

Of 59 historically known sites for *Oxypolis canbyi* in North Carolina, South Carolina, and Georgia, 32 sites were visited, 23 of which were inventoried in detail. At each of the 23 inventory sites, *O. canbyi* population data, pond cypress age information, species composition, soil data, and hydrological information were collected. Of the 23 *O. canbyi* sites inventoried, only seven had *O. canbyi* plants in 2006. Twenty sites (87%) had a canopy dominated by pond cypress (*Taxodium ascendens*). The mean age of mature, canopy pond cypress trees cored was 201.6 years (n=20). Of the 123 species of vascular plants found at the 23 study sites, 22 species occurred at more than one-half of all the sites. Most sites had a clay hardpan around 20-30 cm in depth with a mean depth of 27.2 cm (n=21), and maximum high water marks on trees ranged from 0 to 75 cm with a mean of 29.1 cm (n=23). Data from the 23 inventoried *O. canbyi* sites provides a profile of the ecology and flora of the pond cypress savannah, the preferred habitat of *O. canbyi*. The number of *O. canbyi* plants and the number and quality of sites with plants are in decline. There are, however, still many viable *O. canbyi* sites in both South Carolina and Georgia that can easily be protected. Because regulatory protection of isolated wetlands is weak,

long-term viability of the pond cypress savannah habitat will likely depend on land and easement acquisition.

Plant Biology II

- 73 BOLIN¹, JAY F., KUSHAN U. TENNAKOON² AND LYTTON J. MUSSELMAN¹. Old Dominion University¹ and University of Peradeniya, Sri Lanka²—Stable isotope and nutrient relationships in the root holoparasite *Hydnora* (Hydnoraceae).

Hydnora is a genus of unusual plant parasites with a mainly African distribution. Most species of *Hydnora* reside underground and all lack stomata. We estimated transdermal water loss in *Hydnora africana* and *Hydnora triceps* of 0.14 ± 0.02 and 0.19 ± 0.02 mg cm⁻¹ hr⁻¹, respectively. Due to its extremely water conservative nature *Hydnora* may be a useful model for parasite-host uptake. We measured carbon and nitrogen natural abundance stable isotope ratios for 11 *Hydnora*-host associations in southern Africa, including host plants with both CAM and C₃ metabolism. We compared *Hydnora*-host values to 12 mistletoe-host associations, emphasizing relationships between host plants shared of *Hydnora* and the mistletoes, *Viscum* and *Tapinanthus*. Carbon and nitrogen isotope values for *Hydnora* are negatively correlated and carbon isotope ratios mirrored the host photosynthetic metabolism. For the first time we report mineral nutrition relationships for three holoparasite-CAM host associations. Total P and K levels were significantly elevated in the holoparasite relative to the host in most associations. Total Ca, Cl, Mg, N, Na, and S were significantly lower in the host. Mineral nutrition and stable isotope ratios as tools for the interpretation of parasite-host uptake and their limitations will be discussed.

- 74 DUNKERLEY, RACHEL AND MIJITABA HAMISSOU. Jacksonville State University—Investigating the effects of cadmium toxicity on the photosynthetic performance and anti-oxidative stress responses of chloroplasts in *Arabidopsis thaliana* and *Sorghum bicolor* plants.

Metal pollution is constant problem of industrialized world. When released into the environment, the heavy metal pollutants concentrate in the soils and sediments and may potentially be available to rooted and aquatic plants. Cadmium is a heavy metal pollutant of the environment, resulting from agricultural practices, mining, and industrial activities. Cadmium plants growth and development by interfering with the functions of cellular organelles. In plants, its effects include a decrease in chlorophyll concentrations, a reduction in plants abilities to uptake water and nutrient, and a high production of reactive oxygen species (ROS). Plants regulate the concentrations of ROS by synthesizing anti-oxidative enzymes. The objectives of this study are to investigate the effects of cadmium on the photosynthetic performance of chloroplasts in *Arabidopsis thaliana* and *Sorghum bicolor* plants and its effects on the anti-oxidative enzymes superoxide dismutase (SOD) and Peroxidase (PO) expression. Plants were grown in potted soil and maintained in a growth chamber for 4 weeks. Cadmium treatment consisted of watering plants with various concentrations of CdCl₂ for 7 days. Chloroplasts were isolated from the plants to investigate the photochemical reduction of DCPIP to DCPIPH₂. The chloroplast proteins were extracted by further centrifugation and SOD isozymes expressed were detected in polyacrylamide gels and then quantified spectrophotometrically. Our preliminary biochemical data pointed out a possible reduction of ATP-synthase activity by cadmium in contact with plants roots, as indicated by our observed decreased in DCPIPH₂ formation, and that Cd may enhance SOD genes expression in *Arabidopsis* and in sorghum.

- 75 REIGHARD, KENNY, CASIE SANDERS AND MIJITABA HAMISSOU. Jacksonville State University—UVA and UVB may induce synergic oxidative stress responses to *Arabidopsis thaliana* plants and to callus tissues.

The current destruction of the stratospheric ozone layer causes an increased influx of ultraviolet radiations to the earth surface. UVA and UVB are selected as model stressors to comparatively study their effects on plants. UVA with wavelengths ranging from 320-400 nanometers is not absorbed by the ozone layer. It causes indirect damage to DNA by the actions of free radicals such as reactive oxygen species (ROS) and hydroxyl ions that interact with biological molecules and interferes with their functions. UVA is also believed to affect the enzymes responsible for flavonoids biosynthesis. UVB with wavelengths ranging from 280-320 nanometers affects plant growth, development, morphology and metabolisms. UVA and UVB are mutagenic and damaging to DNA by creating nicks in the sugar-phosphate backbone and by forming thymine-thymine dimers. The objectives of our study are to investigate and compare the oxidative stress responses of *Arabidopsis thaliana* plants to UVA and UVB by studying the activities of the enzymes superoxide dismutase (SOD) and peroxidase (PO) and by measuring the photosynthetic activities of isolated chloroplasts. Plants were grown and maintained in a growth chamber for 4 weeks while callus tissues were generated and maintained on Murashige-Skoog media. Adult plants and callus tissues were exposed to UVA and UVB. SOD and Ascorbate peroxidase activities were quantified spectrophotometrically. Chloroplasts were isolated from UV-exposed plants and their performance investigated. Preliminary data indicated that SOD activities increase with increasing UVA doses but decreases with increasing doses of UVB, and that UVA and UVB have differing effects on the chloroplasts activities.

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- 77 SCHROEDER, RACHEL E.^{1,2} AND GARY J. WHITING². Old Dominion University¹ and Christopher Newport University²—The effect of elevated CO₂ on CH₄ emission from an emergent wetland plant.

Methane (CH₄) and carbon dioxide (CO₂) are chemically important “greenhouse gases” that are increasing in atmospheric concentration primarily due to human activities. CO₂ is used by photosynthetic plants, and increasing concentrations have the potential to stimulate plant productivity. Wetlands are a major source of CH₄, and increased productivity in wetland plants may in turn increase CH₄ emissions in wetland areas. In this study, we measured the effect of elevated CO₂ on emergent plant biomass and CH₄ emission from the aquatic plant, *Sagittaria graminea graminea* Michx. under two soil fertilization treatments (A, beginning of experiment and B, midway through experiment). Plants under elevated CO₂ had significantly higher average CH₄ flux rates (40% and 49% higher in treatments A and B, respectively) than plants under ambient CO₂. This was not due to increased aboveground biomass as biomass was not different between CO₂ treatments in Fertilization B (P=0.64), and was higher for the ambient CO₂ plants in Fertilization A (P=0.03). We suggest that stimulation of root biomass and associated belowground processes resulting from the elevated CO₂ treatment may have contributed to the increased CH₄ production and emission by the plants in this experiment.

- 78 HERR, J. M., JR. University of South Carolina-Columbia—The geometry of developmental stages of the female gametophyte in some angiosperms and its relationship to the derivation of phi (Φ) in the Fibonacci summation series.

In the Fibonacci summation series, i.e., 0-1-1-2-3-5-8-13...2584-4181-6765-10,946-17,711..., if 2 divided by 1 represents the first division of a number in the series by the previous number, then the 18th such division will result in the value 1.6180339 (1 + √5 divided by 2) designated as Phi (Φ) which is a constant derivative of subsequent divisions

throughout the series. If the mean width and length of each female gametophyte stage of some angiosperms are used as the initial two numbers in a Fibonacci summation, and numbers in the series are divided by the previous number, then at some point in the sequence of divisions, Phi will be the result. Uniformly for 2- and 4-nucleate stages in plants of close or distant relationship grown in similar or dissimilar environments, Phi is the result of the 18th division in conformity with the classical Fibonacci summation. For all other stages (functional megaspore, 8-nucleate, and mature female gametophytes) with respect to the division that marks the first appearance of Phi in the taxa analyzed, closely related species show greater similarity than do those distantly related. The elliptical design of these developmental stages, each defined by their widths and lengths, may or may not be affected by environmental conditions.

- 79 HAMISSOU, MIJITABA. Jacksonville State University—Can plant tissue technology be used as an approach to studying aluminum toxicity at the whole plant level.

Soil acidity is believed to be a major problem not only in industrialized countries but also in developing countries of the tropics and sub-tropics. When soils become acidic, some heavy metals such as aluminum (Al), zinc (Zn), and cadmium (Cd) go into soil solution and are readily available to plants. Al is toxic to most plant species by limiting growth and development. It is one of the most widespread plants stressor. Al affects plants within a short period of exposure by inhibiting root growth and inducing wilting. Some plant species known to tolerate Al are thought to secrete some organic acids through their root cells to the rhizosphere to chelate and transform Al^{3+} into a less toxic form Al^{2+} . Plant cells and tissue culture technology may offer a rapid and accurate method to studying plant cells responses to environment stresses. The objective of this research is to compare the responses between callus and cell suspensions and whole plants, to aluminum. *Arabidopsis thaliana* and *Nicotiana tobacum* embryogenic callus were initiated and maintained on Murashige-Skoog (MS) media and the cell suspensions were generated from the callus tissues. Whole plants were germinated in Petri-dishes lined with filter papers. Aluminum exposure was performed in a growth chamber at 25°C, 18 hour-light and 6 hour-dark for 24 hours. The activities of selected organic acid dehydrogenases were measured. Plantlets regeneration abilities from callus maintained on Al-containing media was performed. Preliminary data indicated that malate dehydrogenase synthesis appears to be enhanced by Aluminum in the media.

- 80 STALTER, RICHARD, MICHELE CERAMI AND MO CHOO. St. John's University—Forty years of community development in a gamma irradiated pine-oak forest Brookhaven National Laboratory.

The objective of this study was compare community development at four vegetation zones and a control, 40 years after exposed to gamma radiation. In 1962, a pine oak forest was a subjected to ionizing radiation which altered the normally stable pattern of ecosystem behavior. Difference in sensitivity among vascular plant species subjected to gamma radiation was pronounced. At the end of the initial study, Dr. Woodwell, Brookhaven Laboratory, found that the zone at the gamma source receiving greater than 63,000 roentgens (R) was devoid of vegetation. *Carex pensylvanica* was dominant in the zone receiving 27,000- 63,000R, ericaceous shrubs were dominant in the zone receiving 11,000- 27,000R while oaks dominated the zone receiving 3,000- 11,000R. The original pine- oak forest severed as a control. Vegetation was sampled in each of the above zones and control, the pine oak forest, by the quadrat method, during the spring and summer, 20006 to determine rates of recovery of vegetation after a forty year interval of exposure to gamma radiation. *Pinus rigida* has invaded the central zone devoid of vegetation and is the dominant species at this site. The sedge zone is stable and continues to be dominated by *C. pensylvanica*. The relatively stable shrub zone is

dominated by ericaceous shrubs, notably *Vaccinium* spp. and *Gaylussacia baccata*. The oak zone is dominated by *Quercus* spp., while the pine oak forest (control) is populated by *Quercus* spp. and *Pinus rigida* as it did before exposure to gamma radiation.

81 HERR, J. M., JR. University of South Carolina-Columbia—A brief sketch of the life and work of A. C. Moore: First to apply the term, "meiosis to the reduction divisions.

Born in 1866, Andrew Charles Moore was graduated from South Carolina College first in his class in 1887 and served the next ten years as a high school administrator. In 1898 he undertook graduate study at the University of Chicago for two years under the direction of John M. Coulter. On the recommendation of Professor Coulter, he was appointed assistant professor of biology, geology, and mineralogy at South Carolina College in 1901 and was promoted to full professor in 1903. South Carolina College in 1905 became the University of South Carolina, and a separate department of biology was established with Professor Moore serving as its first chair until his death in 1928. He also served as dean of the faculty and twice as interim president of the university. Moore's only research recognition was for his work on sporogenesis in *Pallavicinia*, but he apparently held botanical concepts advanced for his time. Artifacts from his unpublished study of female gametophyte development in *Lilium philadelphicum* suggest that he understood the salient events of Fritillaria type development long before the publication of Babaccioni's account in 1928. A prepared slide labeled in his handwriting, "... Meiosis, Feb. '99..." indicates his use of this term six years prior to its historically recognized origin and publication by J. B. Farmer and J. E. S. Moore (no relation to A. C. Moore).

Plant Systematics II

82 ESTES, DWAYNE. University of Tennessee—The endemic vascular flora of the Interior Low Plateaus physiographic province, U.S.A.

The Interior Low Plateaus (ILP) physiographic province, a region including portions of six states (s IL, s IN, sw OH, c KY, c TN, n AL), supports 29 strict endemic and 23 near-endemic vascular plants. Strict-endemics are those in which all county occurrences are located within the ILP, whereas for near-endemics, only 75% of a taxon's county occurrences are located within the ILP. Although most of the counties within the ILP have at least one endemic taxon, the greatest concentration of endemics is found within Tennessee's Nashville Basin. Other areas within the ILP that have significant numbers of endemics include the Highland Rim of northwestern Alabama, the southwestern Cumberland Plateau escarpment of Tennessee and Alabama, and the southern Highland Rim and Inner Bluegrass of Kentucky. The phytogeographic patterns, habitat, natural history, taxonomic distribution, and conservation status of these endemics will be discussed and compared with the endemic floras of other southeastern U.S. physiographic regions.

83 HORN, CHARLES N. Newberry College—A floristic survey of Lynch's Woods Park, Newberry County, South Carolina.

Lynch's Woods Park is located in the Piedmont physiographic region of South Carolina and includes uplands, steep slopes, and a stream floodplain. The 115 hectare park represents an old cotton plantation which has not been farmed since the 1930s, but includes a maintained powerline right-of-way. A botanical survey of vascular plants was conducted between May 2002 and September 2005. In addition woodland community types were delineated. A total of 528 species of vascular plants were collected, including 13 pteridophytes, 3 gymnosperms, and 512 angiosperms. Of the species found, 16.7% are considered nonnative. Three encountered species are considered rare in South

Carolina: *Anemone berlandieri*, *Eurybia mirabilis*, and *Rhododendron eastmanii*. Plant communities include successional pine and oak-hickory forests in the uplands, mixed mesophytic hardwood forest along the slopes and a developing bottomland hardwood forest along the stream floodplain. The oak-hickory forest is a relatively rare community type in South Carolina. Continued conservation of the park is critical to the survival of the rare species and unusual plant communities.

- 84 DEGARADY, COLETTE¹, J. FURMAN LONG¹ AND JOHN B. NELSON². The Nature Conservancy¹ and University of South Carolina-Columbia²—Vascular plants and landscape inventory of Sandy Island, Georgetown County, South Carolina.

Sandy Island is a riverine island located at the confluence of the Waccamaw River and Big Bull Creek in Georgetown County, South Carolina, on the east side of the Pee Dee River. Approximately 7 miles in length from north to south, it encompasses about 17,000 acres, of which about 12,000 acres are high ground. Its maximum elevation, 73 feet, represents the highest elevation on South Carolina's outer coastal plain. Additional physical features, in part resulting from a tortuous fluvial history, as well as an early 18th Century history of human occupation, perhaps most importantly affected by the old rice industry of Winyah Bay, have resulted in a number of anomalous landscape features. These include an extensive array of parallel, isolated wetlands, dominated variously by pocosins and *Taxodium ascendens* (pond cypress); otherwise, the high ground features an unusual assemblage of *Pinus palustris* (longleaf pine), some individuals at least 500 years old. In addition, evergreen oaks, especially *Quercus virginiana* and *Q. geminata* (as well as a wild array of intermediates) are well represented, commonly associated with longleaf. Nearly 450 species of vascular plants occur here, including a considerable number of relatively uncommon taxa.

- 85 DARR, ANN R.¹, ALBERT B. PITTMAN² AND KATHERINE A. BOYLE². University of South Carolina-Columbia¹ and South Carolina Heritage Trust Program²—Botanical Survey of Brittons Neck Woodbury Tract, Marion County, South Carolina.

The "Woodbury Tract" on Brittons Neck, Marion County, S.C., was botanically surveyed in spring, summer, and fall, 2006. Situated on a long, narrow peninsula of land inbetween the Great Pee Dee and Little Pee Dee rivers, Woodbury encompasses some 25,000 acres of redwater and blackwater bottomlands, deep swamps, isolated wetlands, and upland xeric scrub lands and pocosins – all of which are in public ownership and managed by the S.C. Department of Natural Resources. Previous geophysical studies have dated and characterized eolian, marine, and fluvial processes that have produced a profusion of geomorphological landscape features: Carolina bays, sand rims, dune fields and crests, back barrier flats, and bottomlands, which in turn structure the extant vegetation patterns. Thirty different sites were surveyed and 12 species of state and federal concern were identified. Over 300 species representing 52 families were collected and curated at the A.C. Moore Herbarium, University of South Carolina. Of particular interest is the presence of Cherokee sedge, (*Carex cherokeensis*) more typically found in marl forests and prairie remnants. Modern dating techniques point to a span of 120,000 years during which this landscape was formed and re-worked. Large and numerous live oak (*Quercus virginiana*) and sand live oak (*Q. geminata*) trees may indicate a rather low frequency of natural fire. Given the large area, diversity of geomorphological features, rare species and habitats, and diverse vegetation assemblages, the Woodbury Tract affords a unique opportunity to study a great variety of botanical environments indigenous to the Southeastern Coastal Plain.

- 86 BARGER, T. WAYNE¹ AND DAN TENAGLIA. State Lands Division, ALDCNR¹—Vascular flora of Coon Creek Forever Wild Tract, Tallapoosa County, AL.

The Coon Creek Tract, located in Tallapoosa County, Alabama, is a relatively small (130 ha) tract that was purchased by the State of Alabama Forever Wild Program on February 1, 1995. The tract lies 45 km west of Auburn, AL with the main tributary of the tract, Coon Creek, dissecting the property and eventually emptying into the Tallapoosa River. The tract is managed by the Alabama Department of Conservation and Natural Resources with an emphasis on recreational use, habitat management and rare species protection. Due to a lack of biological surveys, little is known of the biodiversity of Tallapoosa County. For this study, the vascular flora of the Coon Creek tract was surveyed intensely beginning March 2006. As of the deadline for this abstract, 472 plant specimens had been collected, verified and repositied in the herbarium at the Anniston Museum of Natural History. 301 genera and 110 families have been collected from the tract. Asteraceae was found to be the largest family with 69 species. Poaceae, Cyperaceae, and Fabaceae were the next largest families with 44, 30, and 29 species, respectively. *Carex* was the largest genus represented with 15 taxa.

87 CANCELED

- 88 CLARK, ROSS C. AND TIMOTHY J. WECKMAN. Eastern Kentucky University—Distribution patterns of Kentucky woody plants.

A recently completed study of more than 40,000 specimens has established that plants of 415 woody taxa presently grow wild in Kentucky. The comprehensively documented data from our study reveal the distribution patterns of native, introduced and rare taxa, and plants near the edges of their ranges. In addition to examples of various range distribution patterns, we will discuss second-order issues raised by our study and opportunities for further work, including the status of excluded species, invasives, taxonomic issues and insights, and interesting range discontinuities.

89 CANCELED

- 90 NELSON, JOHN B.¹ AND ALAN S. WEAKLEY². University of South Carolina-Columbia¹ and University of North Carolina-Chapel Hill²—Botanical collaborations between Henry W. Ravenel and Moses Ashley Curtis, 1846-1872.

Henry William Ravenel (1814-1887) is best remembered for his multi-fascicled *Fungi Caroliniani Exsiccati*, issued between 1852 and 1860. Beyond his interest in cryptogamic botany, he was deeply interested in the vascular plants of South Carolina, especially within St. John's Parish (now Berkeley County), and the Aiken area. He amassed a considerable herbarium, which has survived, and includes material from a large number of pre- and post-Civil War botanical contacts. Moses Ashley Curtis (1808-1872) was a transplanted New Englander in North Carolina, whose growing interest in fungi and lichens eventually led him to collaboration with Ravenel, the introduction effected by Asa Gray in 1846. Curtis' early scientific relationship with Ravenel was largely that of a mentor, and at times, considerable rivalry between them was evident. Nevertheless, the two botanists developed a close mutual friendship by the end of the War, having established an important contribution to Southern botany.

Plant Ecology III

- 91 MARCINKO, SARAH E.¹ AND JOHN L. RANDALL². University of North Carolina-Chapel Hill¹ and the North Carolina Botanical Garden²—Conservation implications of breeding systems, floral phenology and sexual expression in the federally endangered *Ptilimnium nodosum* (Apiaceae).

Knowledge of plant breeding system attributes is essential to the effective conservation of endangered species. The purpose of this study was to examine the relationship and functional consequences of dichogamy, andromonoecy, and breeding patterns in the apoid *Ptilimnium nodosum*, a critically rare protandrous plant. We conducted intra- and inter-floral phenological observations to determine the relative overlap in sexual phases and quantify the opportunities for geitonogamy. We also calculated floral sex ratios among sequentially blooming umbel orders and performed controlled crosses in an *ex situ* population of *P. nodosum*. Flowers are self-compatible, but strong intra-floral dichogamy precludes autogamous selfing (less than 1% seed set). Weak inter-floral dichogamy combined with vegetative reproduction, however, provides multiple opportunities for geitonogamy which characteristically decrease with higher umbel orders. Although low, seed set was comparable among open-pollinated, manual outcrossing, and geitonogamous selfing pollination treatments, indicating a mixed-mating system highly dependent on insect-mediated pollination. Similarly, germination rates were similar among all pollination treatments although higher rates were observed in those that were manually manipulated. Because selfing occurs mostly through geitonogamy (~ 21%), it has probably not been directly selected for per se, but it is a side-effect of the selection for protandry. The decrease in seed set among umbel orders in open-pollinated plants is probably a consequence of reduced numbers of perfect flowers and low pollinator activity. The limitations of sexual reproduction may favor high immediate fitness imposed by vegetative reproduction, which is believed to play a critical role in the short-term persistence of *P. nodosum*.

- 92 JOLLS, CLAUDIA L. AND JULIE E. MARIK. East Carolina University—Much from few: uncommon plants and common paradigms.

Much of the work on the ecology and evolution of rare taxa is put within the species-specific context of their biology, ecology or management. It can be argued that such taxa, because of their infrequency on the landscape, may reflect responses and adaptations to short-term and long-term influences which are unique. Similarly, others have documented that rare and restricted species may differ from common ones in breeding biology, vegetative modes, growth rate, fecundity, dispersal and even levels of ploidy. We argue here, however, that rare taxa, specifically plants, can and have contributed to our understanding of ecological and evolutionary processes, and helped construct theoretical frameworks. Our approach was to review the primary literature using ISI Web of KnowledgeSM with emphasis on approximately 136 federally listed plants of the Southeast Region 4 of the US Fish and Wildlife Service. Not surprisingly, this literature is limited and much of it is dominated by a relative few "charismatic" species of interest or associated with "centers of rare species interest". Nevertheless, these works do include ecological and evolutionary paradigms such as 1) the effect of breeding systems on genetic diversity, 2) polyploidy and rarity, 3) the interaction of adult and seed characteristics with microsite availability, 4) critical phases of life histories and their influence on population dynamics, 5) the role of environmental factors such as fire and disturbance, 6) analytical modeling techniques to predict species occurrence from ecological data, and 7) the effects of biotic interactions with pollinators, competitors and herbivores. We continue to encourage gathering biological knowledge critical for species management and conservation, however, also recommend that those of us who work on rare taxa consider the larger ecological and evolutionary context of this knowledge.

93 MARIK, JULIE E.¹, CLAUDIA L. JOLLS¹ AND SAMARA I. HAMZÉ^{1, 2}. East Carolina University¹ and University of Wisconsin-Oshkosh²—Population viability analysis of a rare, monocarpic, Great Lakes perennial, *Cirsium pitcheri*, (Asteraceae).

Survivorship and fecundity data can be used to create Lefkovitch or stage-based matrices, one method for conducting population viability analysis (PVA). PVA is useful in rare species monitoring to predict a probable time to extinction based on current population size and past population growth rates (λ). *Cirsium pitcheri* Torr. & Gray (Asteraceae) is a federally threatened, monocarpic, dune perennial, native to the Great Lakes region of the Midwestern United States. Loss of habitat, decreasing lake levels, and increased beach use imperil the species as a whole. Pitcher's thistle is currently the subject of long-term research on population demography, genetic diversity, and the success of restoration efforts. Census data for a population of *C. pitcheri* in Sturgeon Bay, Wilderness State Park, Emmet County, Michigan, have been collected yearly since 1995 (excluding 2002 and 2004). Lefkovitch matrix calculations showed population growth rates of less than one ($\lambda = 0.6525 - 0.945$), indicating a population in decline for all year pairs except 2000-01 ($\lambda = 1.0303$). PVA predicted a high probability of extinction, reaching 5% in 12 years, for the Sturgeon Bay population. We also computed elasticities to describe the effects proportional changes in growth, stasis, and fecundity on λ . The results of this work can assist management of *Cirsium pitcheri* by evaluating the status of a current population and identifying life stages critical to population and species persistence. Support from NSF DEB LTREB 0516058 is gratefully acknowledged.

94 BELOTE. R. TRAVIS¹, ROBERT H. JONES¹, SHARON M. HOOD^{1,2} AND BRYAN WENDER^{1,3}. Virginia Tech¹, US Forest Service² and Virginia Natural Heritage Program³—Diversity-invasibility relationships not a paradox in harvested Appalachian oak forests: the rich get richer following disturbance.

Ecological theory and small scale experiments predict lower levels of non-native invasion into species rich compared to species poor communities, but observational studies often report positive relationships between native and non-native species richness. This paradox has been attributed to issues of scale and co-varying extrinsic factors. Disturbance is an important extrinsic factor because it influences resources important to species establishment, and it is deliberately manipulated to meet various objectives in managed ecosystems. However, few studies have manipulated disturbance on large scales and investigated relationships between native and non-native species before and after disturbance. Here, we report how the relationship between native and non-native plant species richness responded to an experimentally applied disturbance gradient in oak-dominated forests. We consider effects of scale and whether results are consistent with various theoretical models for the diversity-invasibility relationships in a community. There tended to be no correlation between native and non-native species richness before disturbance, except at the largest spatial scale, but a positive relationship after disturbance across all scales and all levels of disturbance. Numbers of both native and non-native species were positively correlated with disturbance intensity and with variability of disturbance. Increases in richness of non-native species following disturbance were greater in the most diverse and heavily disturbed sites. These results support both the favorable conditions and resource heterogeneity hypotheses to explain the species invasion patterns, and illustrate that disturbance caused by land management activities may overwhelm biotic resistance to non-native species, if such resistance occurs.

95 CORBYONS, CAROLYN AND DAVID VANDERMAST. Elon University—Biotic resistance to invasion across spatial scales: does evidence from North Carolina Piedmont forests support theory?

There is much interest in the relationship between native species richness and invasive species success. Charles Elton proposed that areas with high native species richness are biotically resistant to invasion but others have found that the strength of the resistance is dependent on the spatial scale at which the relationship is observed. We used a dataset of nested subplots from a variety of habitats in a North Carolina Piedmont forest to look for evidence of biotic resistance to invasion across 8 spatial scales ranging from 0.01m² to 10,000m². We found that at the smallest scale (0.01m²) there was a strong negative relationship ($R^2=.408$) between native and invasive species richness, suggesting biotic resistance. However, as spatial scale increased the relationship became positive and increasingly strong to a maximum $R^2=.99$ for our largest scale (10,000m²). Furthermore, we found that within each spatial scale there was a positive relationship between the proportion of invasive species and overall species richness, which suggests a non-linear, additive degree of invasive success in communities with high native species richness. We believe that the negative association observed at the smallest scale is an artifact of the relationship between scale and the size of plants in the forest, and that biotic resistance plays no part in determining invasive species success in our forest.

- 96 EXTINE, JENNIFER L. AND LAURA E. DEWALD. Western Carolina University—Golf courses and their ability to provide landscape connectivity in western North Carolina.

Habitat fragmentation is a major contributor in the loss of native species. Golf courses are multiple use landscapes consisting of large blocks of potential habitat that could provide connectivity across fragmented landscapes. Fifteen golf courses in western North Carolina (WNC) were evaluated to determine if they differed in their potential to provide connectivity. *Bombus* was used as an initial indicator to compare golf courses. Data analyses showed a significant relationship between floral edge and number of *Bombus*, but only 38% of the variation in number of *Bombus* was explained by length of floral edge. Results of these analyses were used to guide further data collection. Aerial photography and on-site measurements were used to evaluate patch quality and connectivity. Fragstats was used to analyze diversity of patch density, shape, and proximity, cumulative edge length, edge segment density, and average length of segments. Vegetation in golf course patches was classified and mapped to analyze vegetation patterns. Results of analyses regarding the relationship of these characteristics to *Bombus* distribution, and the variation in patch characteristics among golf courses will be discussed. Results of this study can be used to evaluate the usefulness of golf courses to provide potential landscape connectivity, and designers can use this information to strategically arrange patch composition and structure to provide potential connectivity across fragmented landscapes through new and existing golf courses.

97 CANCELED

- 98 OSWALT, CHRISTOPHER M. AND JEFFEREY A. TURNER. USDA Forest Service, Southern Research Station—Common tree species shifts in relative stocking for Kentucky from 1975 to 2004.

Changes in species-specific relative stocking indicate the extent to which a species is either gaining or losing ground in a forested system. Changes may inform scientists as to the current status of a system and aid in forecasting probable future compositional shifts and forest health challenges. Changes of relative stocking values of common tree species in Kentucky from 1988-2004 were investigated using data from the US Forest Service FIA program and compared to values for the period of 1975-1988. Shifts were also mapped. Mean annual increase in relative stocking during the period of 1988-2004 was greatest for *Pinus strobus* and *Acer negundo*, averaging 1.29 and 1.25 percent year⁻¹, respectively.

The largest observed average annual decrease in relative stocking was greatest for *Populus deltoids* and *Prunus pensylvanica*, with a mean decrease of 1.20 and 0.75 percent year⁻¹, respectively. Species with a decrease in relative stocking for both 1975-1988 and 1988-2004 include *Quercus coccinea*, *Q. rubra*, and *Q. muehlenbergii*. Species with an increase in relative stocking over both periods include *A. negundo*, *A. rubrum*, and *A. saccharum*. Results suggest that the *Acer* genus has greatly increased over the past 30 years while the *Quercus* (oak) genus has continually declined. These results support the generally accepted notion that the eastern landscape continues to experience oak replacement by generalist species such as *A. rubrum*. Many early succesional and advance reproduction dependent species are declining. Concomitantly, many shade-tolerant and advance reproduction independent species continue to increase, suggesting general changes in disturbance patterns and an aging forest resource.

99 SCARBOROUGH, ANGELA R. AND HAROLD W. KELLER. University of Central Missouri—Species assemblages of tree canopy myxomycetes related to environmental bark pH and experimental laboratory pH protocols.

Air pollution from acid rain and dry acid deposition contributes to tree injury and death at high elevation sites in spruce-fir forests in Great Smoky Mountains National Park (GSMNP). An estimated 45-95% of the potentially reproductive trees are dying. Acidic cloud cover that characterizes GSMNP may compromise the tree's defense mechanisms, making them more vulnerable to infestation by parasitic insects such as the balsam wooly adelgid. Air pollutants in GSMNP such as nitrates, sulfates, and nitrogen oxides rank it among the highest polluted national parks. Insecticides were administered in the high altitude areas along the Appalachian Trail in an attempt to control the wooly adelgid population. The null hypothesis: bark pH caused by air pollution does not affect myxomycete species assemblages and occurrences for the given known microhabitats on living trees. Bark samples were taken from *Juniperus virginiana*, *Quercus alba*, and *Picea rubens*. Chemical solutions simulating environmental pollutants (NaHCO₃, HNO₃, and H₂SO₄) and a solution containing a soapy insecticide were used in moist chambers. Myxomycete species diversity data obtained from a previous study using the same trees cultured in moist chambers with unbuffered, sterile water adjusted to a pH of 7.0 was used as a baseline comparison. Results indicate tree bark may act as a pH buffer to most solutions; however, the insecticide increased the bark pH near 8.0. Myxomycete species occurrences were comparable to the previous study for most solutions, but the bark wetted with the insecticide had lower species diversity. Funded by UCM's Summer Undergraduate Research Program.

100 STOVER, DANIEL B.¹, FRANK P. DAY¹, JOHN R. BUTNOR², C. ROSS HINKLE³ AND BERT G. DRAKE⁴. Old Dominion University¹, U.S. Forest Service², Dynamac Corporation³ and Smithsonian Environmental Research Center⁴—The effects of elevated atmospheric CO₂ on fine and coarse root growth and biomass allocation in a scrub-oak ecosystem at Kennedy Space Center, Florida.

A major gap in whole-plant ecology lies with our understanding of root system growth, function and distribution. Large belowground structures, in particular, are of interest because of their role in carbon sequestration. Non-destructive methods, including ground-penetrating radar (GPR) and minirhizotron observation tubes, were used to investigate effects of elevated CO₂ on root biomass in a fire dominated scrub-oak ecosystem. Open top chambers have been exposed to elevated atmospheric CO₂ for the past ten years at Kennedy Space Center, Florida. No significant sustained CO₂ treatment effects were observed in fine root density due to root closure. CO₂ significantly affected fine root production and mortality during the early years of fumigation; however, this effect disappeared as fine root closure occurred. Fine root turnover followed this trend.

Survivorship analysis suggested the smallest fine root size classes (<0.1 mm in diameter and <0.25 mm in length) were most susceptible to mortality. Coarse roots had a significant treatment effect ($p=0.049$), with elevated roots having more biomass than those under ambient CO₂ conditions. Overall, 86% of the total biomass is belowground with 78% allocated to coarse roots and 22% to fine roots. Coarse root architecture determinations confirmed the complexity and abundance of large belowground structures in this system. The results suggest that coarse roots may play a large role in the sequestration of carbon belowground in a scrub oak ecosystem, thus having implications to carbon dynamics and ecosystem treatment memory and regeneration following natural burns.

- 101 PEDERSON, NEIL¹, EDWARD COOK², GORDON JACOBY², CHRISTINE LATTIN¹ AND H. MYVONWYNN HOPTON. Eastern Kentucky University¹ and Columbia University²—The influence of age and geographic location on the climatic sensitivity and growth rates of southern temperate tree species.

Forests play an important role on the annual and decadal flux of atmospheric CO₂ levels. The relative importance of factors like land-use history, age structure, exogenous nutrient fertilization (N & CO₂) or climate change on carbon uptake, however, is not yet clear. Tree-ring based networks of more than 1200 total *Quercus alba*, *Q. montana*, *Q. rubra*, *Liriodendron tulipifera* and *Chamaecyparis thyoides* trees living in cut and uncut forests over a large portion of the eastern U.S. is used here to examine influence of some of these factors on individual-tree growth (carbon uptake). Results show that across all species, age does not limit carbon uptake. The oldest trees, in fact, have experienced their highest growth rates in recent decades. Growth rates of *Q. rubra* are flat or declining over the last two decades in the northern end of their network while populations in the southern end are increasing; the opposite is true of *C. thyoides*. Drought is a dominant and nearly consistent constraint on growth for most species across their ranges. Growth of *C. thyoides* is more limited by temperature in the northern end of its network than in the south while within a subregion of *Q. alba*'s and *Q. montana*'s networks, the opposite is true. Taken together, these results suggest that climate influences growth more than elevated atmospheric CO₂ and that old-growth trees can be significant sinks of anthropogenic CO₂.

Genetics, Cellular and Molecular Biology II

- 102 ANDREWS, BETHANY AND MARGARET KOVACH. The University of Tennessee-Chattanooga—The effects of PMP22 on gene expression throughout development.

Charcot-Marie-Tooth disease (CMT) is an autosomal dominant disorder characterized by progressive peripheral neuropathy caused by a gene duplication of the PMP22 gene mapped to chromosome 17. A clinical and genetic variant of CMT is associated with profound and progressive sensorineural deafness. Molecular analysis identified a unique point mutation in the gene PMP22 instead of the common duplication. PMP22 is a member of the family of Growth arrest specific (Gas) genes, which have been shown to regulate gene expression, cell death and cell division. Although expression of PMP22 is highest in myelin-forming Schwann cells, its transcript is also detected in non-neural tissues, particularly at critical developmental time-points. The purpose of this study is to dissect the molecular pathology of deafness using the Tr-J mouse as a model of PMP22-associated auditory dysfunction. Differential display technology was used to characterize gene expression patterns in normal and Tr-J mice in order to identify gene transcripts up-regulated or down-regulated relative to quantitative and/or functional levels of PMP22 gene expression. Preliminary results have identified several transcripts that are differentially expressed relative to the Tr-J genotype. This comparative analysis of gene

expression profiles along with genetic sequencing of differentially expressed transcripts should aid in the understanding of PMP22 function and its interaction with other genes and gene products, and most importantly shed light on its influence of inner ear development and function.

- 103 MURDOCK, CHRISTOPHER A.¹, BRIAN C. SMALL² AND GEOFFREY C. WALDBIESER². Jacksonville State University¹ and USDA-ARS Catfish Genetics Research Unit²—Expression of two SF1 isoforms in response to exogenous GnRH injections in channel catfish *Ictalurus punctatus*.

Steroidogenic factor 1 (SF1) is an orphan nuclear receptor that functions at multiple levels within the hypothalamus-pituitary-gonad reproductive axis. Evidence from multiple species of vertebrates suggests that SF1 may play a critical role in regulating the production and release of gonadotropins (both luteinizing hormone and follicle stimulating hormone) in the anterior pituitary. However, the functional pathways of SF1 in the pituitaries of fishes are unclear. Two putative SF1 isoforms (SF1a and SF1b; Genbank accession no: DQ000612 and DQ291133, respectively) were isolated from channel catfish (*Ictalurus punctatus*) pituitary tissue using reverse transcription-polymerase chain reaction (RT-PCR) and rapid amplification of cDNA ends procedures. Tissue distribution analysis indicated that both SF1 isoforms were also expressed in the hypothalamus, ovary, testis, spleen, and skeletal muscle. Additional expression analyses were conducted using quantitative real-time RT-PCR to measure transcript levels for both SF1a and SF1b in total RNA isolated from the pituitaries of channel catfish. Specifically, SF1a and SF1b mRNA levels were assayed in female channel catfish receiving a single gonadotropin releasing-hormone (GnRH) injection (100 µg/kg body weight). Under these conditions, exogenous GnRH treatment significantly decreased SF1 transcript levels at all time points assayed (2, 4, 8, and 12 hours post-injection) for both isoforms (P < 0.05). These findings suggest that the regulation of gonadotropin release via hypothalamic stimulation (i.e., GnRH) may be directly mediated through the regulation of SF1 expression in channel catfish.

- 104 LEMOINE, FRANCENE J. Northwestern State University of Louisiana—*Saccharomyces cerevisiae* as a model for mammalian chromosome fragile site studies.

A cell's ability to maintain intact chromosomes is essential for normal cellular growth and viability. However, certain chromosomal regions, known as chromosome fragile sites, are prone to breakage when cells are exposed to replication stresses. Once broken, these sites often are involved in translocations and other genome rearrangements which are characteristic of certain types of cancers. We have recently identified a chromosome fragile site in *Saccharomyces cerevisiae* and are using this information to develop a simple, tractable eukaryotic model of mammalian chromosome fragile sites. Currently, we are working to identify the physical and genetic regulators of double strand break formation at yeast chromosome fragile sites. We are also examining the effects of various mutations, some that elevate genomic instability and some that affect recombination, on yeast fragile site stability. Additionally, we are initiating a genome-wide screen for the identification of novel chromosome fragile sites in yeast. The establishment of a yeast chromosome fragile site model system will allow for the advancement of genome stability regulation studies, which are critical to the appreciation of cellular transformation and cancer development.

- 105 CHAMBERS, MELISSA G. AND DWAYNE A. WISE. Mississippi State University—A non microtubule-based spindle matrix in eukaryotic cell division.

The possibility of a non microtubule spindle matrix in eukaryotic cells has been controversial for a number of years. Recently, three proteins, Skeletor, Chromator, and

Megator, have been found in *Drosophila* meiotic and somatic cells. These localize to the nuclear periphery and chromosomes at prophase and to the microtubule spindle at division. They form what has been termed a "spindle matrix". The function of this matrix is not known, but it is suggested to play a role in nuclear organization and microtubule spindle assembly. Clearly, it is important to determine the presence or absence of this matrix in other species and to compare its form and function to that in *Drosophila*. In this paper, we report the results of our cellular and molecular studies for a spindle matrix in other invertebrate and mammalian cells. Preliminary evidence suggests that this spindle matrix exists in meiocytes of the cricket, *Acheta domesticus*, and Chinese hamster ovary cells.

- 106 JOHNSON, MARY AND DWAYNE WISE. Mississippi State University—The metaphase checkpoint in cells undergoing mitosis without chromosome duplication.

Precise control of events in the cell cycle is critical for proper cell function. The cell cycle is controlled by a series of checkpoints, including the metaphase checkpoint. We have used Chinese hamster ovary (CHO) cells as a model for checkpoint control. CHO cells can be arrested with hydroxyurea at the beginning of the DNA synthesis phase of the cell cycle. Subsequent treatment with the xanthine, caffeine, induces cells to bypass the S-phase checkpoint and enter unscheduled mitosis. Cells so treated build a normal spindle and distribute kinetochores, unattached to chromosomes, to the daughter cells. We have used cellular and molecular techniques to study the presence and localization of known checkpoint-associated proteins. Preliminary evidence indicates that some of these proteins are present and functional in treated cells.

- 107 HOLLINGSWORTH, T.J.¹, LESLIE PICK² AND HUA ZHANG². Jacksonville State University¹ and University of Maryland²—Over-eating in larvae due to over-expression of genes in *Drosophila melanogaster*.

Obesity, as a health problem, is a major concern around the world. Body weight is a result of food intake and energy expenditure. It is known that inheritance plays a role in one's ability to maintain an ideal body weight, and some genes that influence body weight have been identified. Our goal is to use *Drosophila melanogaster* as a model system to identify new genes that control eating behavior. *Drosophila* is an ideal genetic system that has powerful tools for gene manipulation. Importantly, *Drosophila* shares many genes with humans, such that experiments carried out in the fly are highly relevant to understanding human physiology. The hypothesis of this experiment is that we can identify genes that cause animals to over-eat, using *Drosophila* genetics. We screened for genes that, when over expressed in the brain, cause over-eating in *Drosophila* larvae. This was done using an EP (enhancer promoter) library, consisting of 120 independent P insertion lines. These lines were crossed to flies carrying an *elav-GAL4* driver, which directs expression in the central nervous system. By adding a blue dye to their food, the amount eaten by the larvae was determined by spectrophotometry. We identified 37 lines that showed an increase in food consumption when compared to lines not containing the insertions. These lines will be re-screened and analyzed in more detail to determine which of them cause specific changes in eating behavior. We conclude that these 37 lines represent candidates for obesity-related genes, which may prove to be conserved in humans.

108 CANCELED: SEE TRI-BETA PAPER SESSION

- 109 DIEHL, WALTER J. Mississippi State University—Phylogenetic patterns of natural selection and gene function reveal selective sweeps in the Mycoplasmales bacteria.

Identifying associations between natural selection and gene function in a phylogeny may reveal mechanisms of divergence, but which can be confounded when neutral processes mimic selection. One such process, selective sweep, occurs when natural selection favors a gene, and linked neutral or slightly deleterious genes also appear favored because of genetic hitchhiking. As more genomes are sequenced, relationships between selection and gene function can be evaluated phylogenetically, and selective sweeps can be detected as similarity in phylogenetic selection patterns among dissimilar gene functional groups. Nucleotide sequences for 14 genes from 3 functional groups of 9 *Mycoplasmatales* species were identified from NCBI-COG functional categories, translated, and amino acids aligned (Clustal X). Nucleotides were re-aligned from amino acid alignments (DAMBE). The phylogeny was reconstructed from 16S-RNA sequences (maximum parsimony, outgroup *Lactobacillus acidophilus*; DAMBE). Natural selection was detected along 2 axes of adaptive space (dN/dS ratios (MEGA) X Neutrality Indices (DnaSP)) at 5 phylogenetic nodes. Significance was set conservatively ($\alpha=0.00002$) to reduce Type I errors. Regardless of functional group, genes showed similar phylogenetic positioning in adaptive space, indicating that selective sweeps likely produce many of the significant deviations from neutrality detected previously. Nevertheless some genes (e.g. heat shock protein *DnaK*) are located significantly outside the consensus neutral region, deduced phylogenetically, and thus are more likely to be the direct targets of selection. Although fewer genes show evidence of selection by this analysis, more cellular process genes do so (3/10) than metabolism genes (0/4), as previously suggested. Supported by NSF EPSCoR 0082979.

Ichthyology

110 BILLINGTON, NEIL¹, RACHAEL N. KOIGI¹, RYAN P. FRANCKOWIAK², BRIAN L. SLOSS², JINGYUAN XIONG¹ AND WILLIAM GARDNER³. Troy University¹, University of Wisconsin-Stevens Point² and Montana Department of Fish, Wildlife and Parks³—Population genetic structure of sauger in the upper Missouri River system.

Resolving the genetic structure of native sauger (*Sander canadensis*) populations is essential for developing a management plan for conserving their genetic integrity. A principle threat to upper Missouri River sauger is the loss of genetic variability from reduced population size. Few studies have examined the spatial distribution of genetic variation among sauger populations. Genetic variation was surveyed in sauger from 21 sites by protein electrophoresis and microsatellite DNA analysis to determine how it is partitioned among sauger populations throughout the upper Missouri River basin. Due to small sample sizes, individual sites were combined into conglomerate populations based on presumed barriers to migration and major geographic/hydrologic features. Based upon the allozyme data, sauger exhibited moderate population structuring with some conglomerates exhibiting heterozygote deficiencies consistent with the Wahlund effect. Microsatellite genetic diversity showed less structuring among the major drainages, consistent with wide-ranging migration of sauger within the main-stem of the upper Missouri River. The Bighorn River, WY, population was significantly different from all other populations suggesting this population should be managed as a distinct genetic unit. The lack of fine-scale structuring among population conglomerates was likely due, in part, from samples mostly being collected during the summer and fall, a period when sauger are highly mobile, rather than during the spring when sauger are presumed to segregate into discrete spawning aggregates. Nevertheless, these findings provide a foundation for developing future research and management initiatives aimed at conserving the genetic integrity of native sauger populations.

- 111 BARR, AMY, RACHAEL N. KOIGI, JANET GASTON, RONALD E. CREECH, AND NEIL BILLINGTON. Troy University—Hybridization between walleye and sauger determined by protein electrophoresis.

Walleye (*Sander vitreus*) and sauger (*S. canadensis*) are large predatory percoid fishes that are highly prized by anglers. They hybridize naturally and their F₁ hybrid the saugeye (female walleye x male sauger) is propagated by fisheries managers because it performs well in impoundments. The F₁ hybrids backcross with the parental species leading to introgression. Several studies have shown that protein electrophoresis is more reliable than morphological examination for identifying hybrid and introgressed fish. Cellulose acetate gel electrophoresis at four diagnostic loci (ALAT* and IDDH* from liver, and mMDH-1* and PGM-1* from muscle) was used to examine >2000 fish collected from Iowa (one population), Montana (15 populations), South Dakota (three populations), Wyoming (two populations), and Saskatchewan, Canada (one population) to document hybridization and introgression between sauger and walleye. Hybridization was not detected in Wyoming. In the Mississippi River Pool 13, Iowa, 25% of individuals were hybrid/introgressed. In Montana, 0-10% of sauger from the Yellowstone River and 0-22% from the Missouri River contained walleye alleles. In South Dakota, on average 4.2% of fish were hybrids in Lake Sharpe, 3.9% in Lake Francis Case, and 21.2% in Lewis and Clark Lake. In Lake Diefenbaker, Saskatchewan, 20.9% of fish were hybrids. Hybrid numbers were usually underestimated by morphology. Morphological examination was unreliable for separating walleye, sauger, and their hybrids compared to protein electrophoresis. Fisheries managers should consider genetic screening of walleye and sauger if they co-occur to determine hybridization rates, especially if hybrid saugeye have been stocked in a drainage basin.

- 112 WELSH, STUART A.¹ AND DAN A. CINCOTTA². U.S. Geological Survey¹ and West Virginia Division of Natural Resources²—Conservation status and population extirpations of *Etheostoma osburni* (candy darter) in West Virginia.

Etheostoma osburni is endemic to the upper Kanawha River system of West Virginia and Virginia. It inhabits cool to warm waters of small streams to medium sized rivers in the Ridge and Valley Province of Virginia and West Virginia, and the Appalachian Plateau of West Virginia. Due to extirpations and/or low numbers at certain sites and a lack of recent data, conservation documents have listed this fish as a species of concern in both states and consequently, at the federal level. In 1991, a survey to determine the abundance of candy darters at historic locations in the Monongahela National Forest suggested that West Virginia's population was declining. In response to this limited survey and the federal designation, the West Virginia Division of Natural Resources initiated a survey in 1993 to evaluate the status of the candy darter throughout its entire range in the state. To date, approximately 40 of 50 historic candy darter sites (i.e., localities established prior to 1980) have been visited, including many sites during 2005. This new information reveals that, although this species is probably declining or has been extirpated from certain waters within its West Virginia range, several excellent sites still exist. Reasons for population declines are presented and new threats are identified, including hybridization with the introduced variegate darter.

- 113 ROBERTS, MATT E.¹, CAROLYN S. SCHWEDLER² AND CHRISTOPHER M. TAYLOR³. Mississippi State University¹ and Michigan State University²—Dietary shifts in the crystal darter (*Crystallaria asprella*) after large-scale river fragmentation.

The crystal darter, *Crystallaria asprella* (Jordan), is a benthic, riverine specialist, rare throughout its range and critically imperiled in the state of Mississippi. Construction of the Tennessee-Tombigbee Waterway has fragmented a once continuous population of this

species into several subpopulations in remaining, free-flowing tributaries of the system. In spite of this fragmentation and population subdivision, we collected numerous individuals from the waterway during summer 2004 and 2005. Because of the lentic conditions in the waterway, we questioned whether a dietary shift accompanied darters occupying this new environment. We also obtained museum specimens from the Tombigbee River before waterway construction and quantified and compared diets among the historical, tributary (contemporary), and waterway specimens. We hypothesized that waterway specimens would differ significantly in diet from both historical and tributary specimens, and that the latter two groups would have similar diets. Multi-response permutation procedures indicated that all three groups were significantly different from each other and indicator species analysis identified significant indicator taxa for waterway and tributary specimens. Using a null model approach, dietary overlap was significantly greater than expected for tributary and waterway specimens, and significantly less than expected for waterway and historical specimens. Dietary plasticity was evident for crystal darters across space and time, but it remains unknown whether waterway individuals represent a population sink or are actively dispersing from nearby population sources.

- 114 MILLICAN, DANIEL S. Mississippi State University—Variably scaled environmental influences associated with fish assemblage patterns in the Tombigbee River System following mainstem impoundment.

Large-scale inundation disturbance arising from flow modifications to the Tombigbee River System has resulted from construction of the Tennessee-Tombigbee Waterway. The Tombigbee River in northeast Mississippi has been deepened, widened, impounded, and connected at its upstream reach by man made canal to the Tennessee River. In order to assess both remaining fish diversity and the adverse impacts of large-scale flow alteration, environmental variables and fish assemblages were sampled from variably disturbed locales. From least to most disturbed, sampled locales included tributaries to the Tombigbee River, historical Tombigbee River channel assimilated into the waterway, navigation cutoffs in the waterway that bypass severed bendways of the historical Tombigbee River channel, each of flow regulated and stagnant bendways of the Tombigbee River severed by navigation cutoffs, and each of connected backwaters and reservoirs within the inundated floodplain. Local environmental variables correlating with sites scores ordinated by fish assemblage structure were obtained by partial canonical correspondence analysis. The relative explanatory power of multiple scales of environmental variability were identified using variance partitioning canonical correspondence analysis. The relative importance of local environment, longitudinal stream development, remote disturbance, and ecoregion as predictor variables under which fish assemblages may be structured will be discussed.

- 115 HOLDER, DERRICK S. AND STEVEN L. POWERS. Reinhardt College—Life History of the Rainbow Shiner, *Notropis chrosomus* (Teleostei: Cyprinidae) in Northern Georgia.

The biology of the Rainbow Shiner, *Notropis chrosomus*, was investigated using 12 monthly collections from Moore Creek at GA Highway 140 (Etowah River Drainage) in Cherokee County, Georgia. Specimens were collected by electro-shocking and seining primarily from runs and flowing pools. The majority of the stomach contents collected from the specimens contained unidentifiable aquatic insect parts. Stomach contents that could be identified included Dipteran adults, Chironomidae larvae, and Ephemeroptera nymphs were primary food items of *N. chrosomus* examined. Spawning appeared to occur in the early summer with 400-732 ripe eggs ranging from 0.97 mm to 1.22 mm present in specimens collected in April, May and June. The largest female collected was 66.71 mm SL and 5.515 g total weight. The largest male collected was 60.19 mm SL and 3.691 g total weight.

Teaching Biology

- 116 TIMMERMAN, BRIANA. University of South Carolina-Columbia—Development of a universal lab rubric for assessing students' science inquiry skills.

We report on the development and testing of a universal rubric for lab reports designed to measure student ability to engage in authentic scientific inquiry. The rubric's reliability was tested using three different assignments from three different higher-education biology courses (45-50 unique student papers per assignment, total reports n=142) with three unique raters per assignment (total = nine raters). We provided a five-hour training session to the science graduate students comprising the scoring team prior to initiation of formal scoring. Additionally, a parallel but non-overlapping set of untrained science graduate students (n=8 raters) evaluated the same papers using the same set of criteria. Generalizability analysis indicates that the rubric is a reliable metric (inter-rater reliability 0.85 for each of three groups of trained raters). Further, comparison between the trained scorers using the rubric and the "natural," untrained grading condition provide a baseline reliability of science graduate students for evaluating student work. Lastly, application of the rubric to portfolios of student work over multiple courses provided both a measure of student achievement as well as curriculum effectiveness. We therefore encourage the use of the rubric at multiple levels: 1) assessment of student abilities within a course; 2) student achievement over time/multiple courses; 3) evaluation of curricula.

- 117 CARSTENSEN, SUSAN. University of South Carolina-Columbia—Internet hoaxes as a way to improve scientific judgment and critical thinking.

Have people really died after being bitten on the derrière by a spider named *Arachnis gluteus*? Are flesh-eating bacteria posing a threat for students living in dorms? Internet hoaxes enliven the first day of Introductory Biology and set the stage for an interactive class in which everyone is expected to think critically about claims and evidence. Students examine claims made in "warnings" sent by email and search for evidence that supports or refutes the claims. These are "warnings" of the type that are often sent uncritically and spam-like around college communities, mixed in with several "strange-but-true" tales of real biological phenomena. Students must use the evidence and their judgment to declare each "warning" True, Bogus, Bogus But with a Grain of Truth, or True But Sensationalized. This teaching module also allows instructors to check student skills with email and the Internet. I will provide a synopsis of this teaching module and provide materials and suggestions for adapting it to your class.

- 118 SCHAUS, M., E. MALCOLM AND M. REESE. Virginia Wesleyan College—Use of green roof research in science and statistics courses.

During the past year, we have incorporated green roof studies into 5 different Biology, Earth & Environmental Science, and Statistics courses. Students were involved in the experimental set-up, field sampling, chemical sample analysis, statistical data analysis, written project reports, and project presentations. Initial studies (Nov. 2005 – Nov. 2006) focused on test plots designed to simulate different green roof designs, including a standard green roof, with and without water retention and drainage layers and standard gravel roof plots. Students measured water runoff volume, and concentrations and discharge of mercury, nitrogen, and phosphorus at different times of the year. These findings were then used to recommend a design for full roof implementation on a residence hall. Initial studies found that green roofs reduced water runoff by 45-99% and could also decrease mercury discharge. However, phosphorus and nitrogen discharge from green roofs were substantially elevated over that of conventional roofs, due to leaching from fertilizer and compost. Our current whole-roof study and our revised test plots (Nov. 2006 through 2008) will examine how to best mitigate this nutrient effect

through fertilizer reduction or through granules designed to adsorb phosphorus. Overall, this project has been an effective means to engage our students in the active practice of the scientific method. Green roof studies were used in both upper- and lower-level courses and for undergraduate research. In addition, the conspicuous location of the test plots has helped to educate the campus community about ways that we can reduce our environmental impact.

- 119 STOCKS, STEPHANIE D. Clemson University—Turning your classroom into a butterfly house—tips on raising Painted Ladies (*Vanessa cardui*) for classroom studies.

The search for a charismatic organism to rear in the classroom that captures the students' interest, is relatively easy to care for, does not require lots of classroom time (and especially weekend time) to maintain, and that will also help illustrate educational standards can be a daunting task for teachers. In this presentation, I will supply tips for raising painted lady butterflies and discuss how they can be used to address multiple K-12 National Science Education Standards such as life cycles, basic needs, reproduction, and behavior (Life Science standards) as well as several Inquiry standards.

120 CANCELED: NOW POSTER 3B

- 121 BLAIR, BENJIE. Jacksonville State University—"Poor man's cryo" a simple method of teaching electron microscopy to undergraduates.

Outstanding teaching in science today is no longer only the communication of existing knowledge, rather it increasingly involves faculty as mentors and role models in stimulating pre-college students and college science majors to explore new frontiers and horizons through their own investigative studies. The JEOL 5500 series microscope enhances student analytical skills and scientific inquiry and pre-college science interest. The system is so user-friendly that relatively inexperienced students, after a short amount of time can acquire meaningful data efficiently and effectively in many diverse and multidisciplinary undergraduate research areas. The "bottleneck" in undergraduate training has always been the specimen preparation in addition to safety concerns. This series of microscope allows low vacuum observation of specimens and when combined with "poor man's cryo" it becomes a tool to rapidly train students in the art of electron microscopy. This presentation will candidly discuss the benefits and pitfalls of incorporating SEM into the undergraduate curriculum at Jacksonville State University. Funding for the equipment was obtained from a NSF-CCLI grant #0088299.

- 122 HANMER, DEBORAH¹, SCOTT COOPER² AND BILL CERBIN². University of North Carolina at Pembroke¹ and University of Wisconsin-LaCrosse²—Enhancing student understanding of phylogenetic trees through problem-solving modules.

This study examined the effects of a problem-solving module on student understanding of evolution and phylogenetic trees. In large lecture sections, students were presented with data about several animals and then worked in small groups to produce a phylogenetic tree to explain the data. Instructors collected and visually projected several student models and analyzed them in front of the class. Instructor feedback focused on helping students develop their understanding of the concepts and revising any misconceptions of the material. This sequence was repeated two more times during the class period as students were presented with additional data. The effectiveness of the module was measured by assessing 577 students in six different lecture sections taught by five different instructors. A formative assessment tool was used to measure students' in-class performance. Short answer and multiple choice pre and post tests were used for summative assessment. The

assessments revealed that these in-class modules resulted in significant improvement in student understanding.

123 CANCELED: NOW POSTER 3C

- 124 ALIFF, JOHN V. Georgia Perimeter College —Two approaches to common misunderstandings of science: A survey of student opinion.

A 2005-present Survey of over 500 student opinions at Georgia Perimeter College on the nature of science reveal that a plurality want the [religious] teaching of a "theory of intelligent design" taught in science classes. Two approaches to teaching about the nature of science were compared: 1.) Teach the principles, but not the issue; and 2.) Teach the principles and issue. Results indicate that the latter approach is much more successful in delineating the methods of knowledge and goals of religion and science. This approach may satisfy the requirements of certain laws requiring a "critical analysis" of the theory of evolution. Numbers of students supporting the teaching of intelligent design, confusing the belief systems of science and religion, and believing that science can study supernatural causation declined significantly. However, there is still a significant amount of confusion over the meaning of the term "scientific theory."

- 125 DAVIS, JENNIFER AND JILL BORCHERT. Shorter College—A new approach for undergraduates preparing for health science and counseling careers.

An interdisciplinary major, Health Science and Counseling, has been implemented at Shorter College to better prepare students for various health-related careers in which client/patient counseling and education are important components (e.g. genetics counseling). This major consists of a Bachelor of Arts core curriculum with a language and humanities emphasis and a combined biology/chemistry, psychology, and research sequence including courses in statistics and research design. The ability to read, understand, and interpret scientific literature, to speak more than one language, and to be aware and tolerant of diverse people and cultures are skills and qualities that are essential to provide effective health care to an increasingly diverse U.S. population in the 21st century.

FRIDAY, APRIL 20, 2007

MORNING SESSION

Microbiology I

- 126 WARNER, CHARLENE A. AND MIN-KEN LIAO. Furman University—Structure and function of proline permease in *Salmonella enterica* serovar Typhimurium.

Solute transport is often the rate-limiting, but essential step in metabolism and energy utilization. It is often mediated by active transport systems involving integral membrane proteins (permeases) recognizing and translocating substrates across cytoplasmic membranes. While important, the precise mechanisms of substrate recognition and translocation are not yet understood. In this study, we use proline permease, coded by *putP* gene, in *Salmonella enterica* serovar Typhimurium as a model to investigate the structure and function of a permease. This proline permease has been well characterized genetically and biochemically, and numerous substrate-specificity mutants and revertants have been isolated. Substrate specificity mutants have altered substrate recognition function, and the revertants of substrate specificity mutants partially, if not completely, regain altered substrate recognition function. We hypothesized that substrate specificity

mutants have mutations located in the proline binding site and identifying these mutations will aid us in determining which amino acid residues are involved in substrate recognition. To further identify the proline binding domain, the DNA sequences of proline permeases of multiple organisms have also been aligned. Additionally, identifying mutations in the revertants will aid us in determining which amino acid residues directly interact in the proline binding site. Forty-four substrate-specificity mutants and revertants were sequenced. All substrate specificity mutations are located in the shared proline binding domains. Of the 29 sequenced revertants, 11 are true revertants, 17 are intergenic revertants, and one is intragenic revertant. Since only intragenic revertants can shed light on amino acid interactions, more revertants need to be sequenced.

127 CANCELED: SEE TRI-BETA POSTER SESSION

- 128 BARGER, KATIE, LAURA CECERE AND HENRY SPRATT. University of Tennessee-Chattanooga—Development of a bacterial battery for the generation of electric current from the mineralization of organic matter in sewage.

We hypothesized that *Geobacter* present in untreated sewage will metabolize organic matter to produce an electric current. Six bacterial batteries were constructed using 10-gallon aquaria, each including two graphite anodes (in the tank bottom) and two graphite cathodes (near the tank surface). A semi-porous Plexiglas barrier was inserted between the anodes and cathodes to create an anoxic environment for *Geobacter* on the anodes. The anodes served as the metabolic electron acceptor for the bacteria. Current generated traveled from anode to cathode and was quantified using electric meters. After allowing the battery cells to equilibrate with no added *Geobacter*, no current was observed. Later, the battery cells were inoculated with dilute sediment slurry collected from another working battery made using riparian wetland soil. Injection of acetic acid, into the cells caused increased current generation in all cells. Injection of glucose into these cells also resulted in current production, albeit at a considerably slower rate than addition of acetate. Future studies with these batteries will include the addition of untreated sewage to test the efficacy of this system to generate current at the expense of the mineralization of organic matter in the sewage. This experiment has implications for how septic tanks could be designed to generate electric current that could be used for a variety of different uses. Additional work is underway to determine the efficacy of this battery system to store energy generated as the sewage organic matter is mineralized via electrolysis of H₂O into H₂ gas.

- 129 DUDLEY, BREANNA¹ AND BRADLEY RINGEISEN². Bowie State University¹ and Naval Research Laboratory²—Miniature microbial fuel cell using alternative fuels and electrode materials.

Biological fuel cells are electrochemical devices that are capable of generating current from biochemical pathways and precursors. Microbial fuel cells (MFCs) are a subset of biological fuels cells that show particular promise for long-duration distributed autonomous sensor (DAS) networks or *in vivo* sensing applications by continuously generating power from indigenous nutrients. A miniature-microbial fuel cell (mini-MFC, chamber volume: 1.2 mL) was used to monitor biofilm development from a pure culture of *Shewanella oneidensis* DSP10 on graphite felt (GF) under minimal nutrient conditions. These experiments demonstrate that power density per volume for a biofilm flow reactor MFC should be calculated using the anode chamber volume alone (250 W/m³), rather than with the full anolyte volume. Several electrodes were also tested including graphite felt, titanium microparticles, and Pt on vulcanized carbon. Finally, the mini-MFC was used to test a wide variety of nutrients (glucose, acetate, sucrose, etc...) for power production which could lead to a diverse array of applications for MFCs using facultative anaerobes.

- 130 JONES, NICORY, INIGO HOWLETT, RYAN MILLER, OLIN IVEY, AND HENRY SPRATT. University of Tennessee-Chattanooga—Bacterial sulfate reduction in surface soils from the former Volunteer Army Ammunition Plant near Chattanooga, Tennessee.

Rates of sulfate reduction by soil microbes were measured for wetland and upland sites located on the former Volunteer Army Ammunition Plant (VAAP) site near Chattanooga, Tennessee, where the explosive TNT was manufactured intermittently from 1942 to 1977. Sulfate reduction rates were determined using a $^{35}\text{SO}_4$ tracer technique, coupled with chromium reduction distillation to quantify microbial generation of reduced inorganic sulfur compounds in these soils over the incubation period. Soil samples from the top 2.5 cm and from 7.5 to 10 cm depth were collected from each site from replicated stations in mid September 2006. In the lab, the soils were processed under a stream of N_2 gas, with aliquots transferred into 3 cc syringes before the addition of 1 mCi of radiolabel. Sample incubations were terminated after 24 hours by freezing. Overall, rates of sulfate reduction were greater in wetland soils compared with upland soils (0.157 vs. 0.0046 mmoles/g/d, respectively). Within the wetland sulfate reduction rates were greatest in the top 2.5 cm, compared with the lower depth (0.157 vs. 0.016 mmoles/g/d, respectively). The percent soil moisture was the major factor contributing to the sulfate reduction differences observed. The organic matter content of soils from the two sites probably had less effect on sulfate reduction rates than soil moisture. Future studies of sulfate reduction in soils from these sites will focus on any potential impacts former activities at VAAP, including a major sulfuric acid production facility, may have had on sulfur cycling in either the upland or wetland soils.

- 131 HOWLETT, INIGO, RYAN MILLER, NICORY JONES, OLIN IVEY AND HENRY SPRATT. University of Tennessee-Chattanooga—Effect of habitat type on lignocellulose mineralization in surface soils from the former Volunteer Army Ammunition Plant near Chattanooga, Tennessee.

Rates of microbial lignocellulose mineralization were measured for wetland and upland surface soils from sites at the former Volunteer Army Ammunition Plant (VAAP) near Chattanooga, Tennessee, where TNT was periodically manufactured from 1942 until 1977. Lignin and cellulose mineralization rates were determined using a ^{14}C -labeled tracer technique (*Quercus alba* ^{14}C -labeled lignin and cellulose). Soil samples (0-2.5 cm and 7.5-10 cm depth) were collected from replicated stations in each habitat type in mid September 2006. In the lab, the soils were added to microcosms where the release of $^{14}\text{CO}_2$ from the lignin or cellulose was quantified. Overall, mineralization of cellulose was greater than lignin at either site (varying from 0.142 to 0.004 mgC/g/d for cellulose, and 0.013 to 0.0008 mgC/g/d for lignin). Cellulose mineralization was as much as 15 times greater in upland soils compared with soils from the wetland site. Factors that may affect the rates of lignocellulose mineralization observed include soil moisture and soil organic matter content. As expected wetland soils had greater soil moisture than upland soils (78% vs. 34%, respectively). Soil organic matter also differed between the two habitats (32.4%, wetland, vs. 30.9%, upland, averaged over the top 10 cm for each habitat). Diffusion of O_2 into the soils due to higher soil moisture in the wetland soils may have contributed to the differences in lignocellulose mineralization. Future studies of these sites may include comparisons with other local soils to determine if past activities at the VAAP site had any lasting impacts on soil microbial carbon cycling.

Herpetology I

- 132 PRICE, STEVEN J. AND MICHAEL E. DORCAS. Davidson College—Do land-use legacies affect contemporary abundance patterns of semi-aquatic reptiles and amphibians?

Studies in conservation biology and wildlife management often correlate the abundance or presence of organisms to current land cover. From these studies, inferences are often made regarding species-habitat relationships, population ecology, and management recommendations. However, past land use and/or cover may be an equally or more important determinant of a species contemporary distribution across a landscape. Many reptile and amphibian species exhibit low vagility and high susceptibility to habitat disturbance, suggesting that current patterns of abundance and distribution may be a reflection of land-use legacies. In this study, we investigated the influence of land-use legacies on contemporary abundance patterns of some semi-aquatic reptile and amphibian species in the western Piedmont of North Carolina. Specifically, we 1) generated hypotheses for several species based on life-history attributes, such as life-span, dispersal ability, and habitat preferences, 2) examined historical aerial imagery from the 1930s through the 2000s to quantify land use surrounding farm ponds and first-order streams, and 3) identified, using regression analysis, the land-use history that best explained the patterns of present-day abundance. Results provide valuable insights into reptile and amphibian population persistence and recovery, dispersal capabilities, and habitat restoration efforts. We also discuss the potential effects of current land-use attributes on future reptile and amphibian distributional and abundance patterns.

- 133 ADAMS, JENNIFER P¹. AND THOMAS K. PAULEY². Salem International University¹ and Marshall University²—Home range and behavior of *Crotalus horridus* in high elevation production forests, Randolph County, West Virginia.

Crotalus horridus is an integral component of eastern deciduous forest ecosystems in North America. The ecological significance of *C. horridus* is implied by its broad geographical distribution. In many areas their niche remains unfulfilled from extirpations, caused by combinations of anthropogenic, biological, and ecological factors. These factors were studied in *C. horridus* populations on production forests in high elevations of West Virginia. Telemetered captures were radio-tracked from 2000 through 2002 to locate and characterize sites of overwinter dens, basking areas, and rookeries; identify forest cover types; ascertain home range sizes; document phenology; determine cause-specific mortality; and discern behaviors. Den sites, basking areas and rookeries occurred at forest interiors and edges. Snakes were located in clearcuts, mature forests and nonforest hardwoods. Mean home range sizes were 94.3 ha, males; 31.2 ha, non gravid females; 8.5 ha, gravid females; and 44.7 ha, combined. Mean daily movement rate was 20.2 m per day; mean maximum known distance from den sites was 1110.2 m; mean distance from overwinter dens was 514.2 m; and mean distance moved was 2852.9 m. Mean active season was 165.5 days, males; 171.0 days, females; and 167.3 days, combined. Specific causes of nonresearcher mortality included mammalian predators (17.6%), avian predators (5.9%), and vehicles (17.6%). Remains of vehicle-induced mortalities were unobservable from roads, suggesting caution in using roadkill studies for *C. horridus*.

- 134 MORRIS, TIMOTHY A. AND ROLAND P. ROBERTS. Towson University—Validating locality claims of green tree pythons (*Morelia viridis*) using microsatellites: Implications for the captive market and conservation of the species.

Green tree pythons (*Morelia viridis*) are found only on New Guinea and its associated islands as well as on the Cape York Peninsula of Northern Australia. Because these snakes are visually striking, many specimens have been imported into Europe and the United States over the last 30 years. The increased trade of this species and the overall increase in the trade of live reptiles necessitates improved estimates of sustainable take from wild populations. However, assessing the take from the wild is complicated by a lack

of reliable collection data for imported animals. Moreover, this species is widespread and morphologically similar, complicating population assignment based on morphology. This study uses cluster analysis of microsatellite markers to delineate three morphologically similar populations of the Green Tree Python in order to ascertain whether animals with unknown collection data can be assigned to the correct source population using genetic markers. Populations included in this study are from the Aru Archipelago, southern New Guinea (south of the central mountain range), and Australia (Queensland). Amplification and analysis of microsatellite loci revealed several alleles that are population specific. Data resulting from the application of these primers across all sampled individuals and populations will be analyzed using Structure v2.1 to ascertain if samples with unknown or equivocal locality designations will cluster with individuals of known localities.

135 CANCELED

- 136 GRAHAM, MATTHEW R.¹, WILLIAM D. FLINT², A. ALLISON HOGSETT¹ AND THOMAS K. PAULEY¹. Marshall University¹ and James Madison University²—Phylogeography, distribution, and conservation unit designation of the Cow Knob Salamander (*Plethodon punctatus* Highton).

Being lungless, plethodontid salamanders respire through their skin and are especially sensitive to environmental disturbances. Habitat fragmentation, low abundance, extreme habitat requirements, and a narrow distribution of less than 70 miles in length, makes one such salamander, *Plethodon punctatus*, a species of concern (S1) in West Virginia. To better understand this sensitive species, we conducted day and night survey hikes through ideal habitat and collected coordinate data and tail tips (10 to 20 mm in length) from specimens. DNA was extracted from the tail tips and polymerase chain reaction (PCR) was used to amplify mitochondrial cytochrome *b* gene fragments. Maximum parsimony algorithms were used to produce a phylogenetic haplotype tree, rooted by two samples of *P. wehrlei*. To analyze gene flow, nested clade phylogeographical analysis (NCPA) was conducted by first producing a haplotype network and a nested cladogram. Using GEODIS 2.5 we performed statistical tests of clade distances (D_c) and nested clade distances (D_n) which were interpreted using the revised inference key of Templeton (2004). Our study provides new insights to the spatial genetic structure of *P. punctatus*, determines which populations should be of priority for conservation efforts, and provides new records and a range expansion for the species. We hope that our data will increase the efficacy of Cow Knob Salamander conservation efforts by providing the means to implement management plans that conserve intraspecific genetic diversity.

- 137 FARR, JONATHAN AND ALVIN DIAMOND. Troy University—Species richness and diversity of treefrogs in Lillian Swamp, Baldwin County, Alabama.

This study used PVC pipe refuges and call surveys to assess treefrog population diversity and richness in Lillian Swamp from February to September of 2006. Lillian Swamp is located in Baldwin County, Alabama, and is managed as a nature preserve by the Alabama Department of Conservation and Natural Resources. The vegetation of the preserve consists of slash pine and bay lowlands with associated pitcher plant bogs. Thirty PVC pipes were placed at each of 10 sites located throughout the preserve (n=300), and checked weekly. Treefrogs were toe-clipped to avoid double counting and snout-vent length was measure to the nearest millimeter. Call surveys were performed weekly for 15 minute periods in close proximity to sunset and/or rain events. A total of 676 herpatofaunal species were documented. Two species were captured using PVC pipe refuges: *Hyla femoralis* (n = 315) and *Hyla cinerea* (n = 147). *Acris gryllus doralis* (n = 42) and *Hyla femoralis* (n = 40) were the most common species documented by call, and *Acris gryllus doralis* (n = 48) and *Rana uticularia* (n = 41) were the most common species documented by visual searches. Results from this study are similar to other studies performed in

northwestern Florida and southern Georgia. Capture rates may have been low due to extreme drought conditions during the survey.

- 138 BEAMER, DAVID A. AND TRIP LAMB. East Carolina University—A case for parallelism among dwarf salamanders in the *Eurycea quadridigitata* complex.

The dwarf salamander (*Eurycea quadridigitata*), a small, slender plethodontid characterized by digital reduction, was traditionally viewed as a single widespread species inhabiting both Atlantic and Gulf coastal plains and portions of the lower Piedmont. However, a second species confined to the Carolinas (*E. chamberlaini*) was described in 2003. Here we present the results of a range-wide phylogenetic survey for dwarf salamanders. We confirm the hypothesized sister status of *E. quadridigitata* and *E. chamberlaini* but demonstrate that dwarf salamanders west of the Mississippi River are more closely allied to species of *Eurycea* from Texas. This unexpected finding provides evidence for parallelism among dwarf salamanders with respect to small body size, larval morphology, and, most significantly, loss of a fifth toe on the pes. In turn our findings lend support to the hypothesis that toe loss represents a design limitation imposed by the large genome size of plethodontid salamanders.

- 139 ESQUIVEL, JORGE L., ROBERT WAYNE VAN DEVENDER, SHEA TUBERTY AND JOHN WALKER. Appalachian State University—Chytrids vs. Amphibians: Emerging disease or history of natural selection?

Amphibians secrete antimicrobial peptides from skin granular glands that inhibit growth of the waterborne chytrid fungus *Batrachochytrium dendrobatidis*, major cause in amphibian population declines. Furthermore, in contrast with indirect development (ID) (with aquatic larvae), amphibians with direct development (DD) (without aquatic larvae) could reflect an evolutionary response to escape past chytrid infections. I collected 10 individuals of six different species of salamanders (3 DD, and 3 ID) in Watauga and Caldwell counties, NC and collected peptides secreted by amphibians with DD or ID from the Santa Ana Conservation Center (Santa Ana, San Jose, Costa Rica); Tapantí National Park (Cartago, Costa Rica) and sites in land administered by Friends of Osa FOO and in the property of Porfirio Sanchez Marengo (Osa, Puntarenas, Costa Rica). Peptide secretions were induced by injection of 10ul of norepinephrine per gram of amphibian's mass, collected in amphibian buffer solution and passed through 2 linked C18 Sep-Pak cartridges for further peptide content and antimicrobial activity analysis. A chytrid inhibition assay will be done with zoospores averaging 500000/ml added to 96 wells micro plates with isolated peptides of amphibians of Costa Rica and the Appalachians. The antimicrobial activity of the peptides will be evaluated by comparison of optical density (OD) with a wavelength of 490nm. Looking for a minimal inhibitory concentration, a significant reduction in the absorption of light compared with controls will indicate antimicrobial activity of the peptides against the chytrid fungus.

Plant Ecology IV

- 140 ZOELLNER, DANIELLE C. AND KEVIN S. GODWIN. Coastal Carolina University—Analysis of local and landscape level factors influencing development of three community types within Carolina bays in northeastern South Carolina.

Carolina bays are one of the most interesting and unique wetland features of the southeastern Atlantic Coastal Plain. These elliptical wetlands range widely with regards to size and are most commonly described as precipitation driven, isolated wetlands that contain several different vegetation types. Carolina bays located in the northeastern portion of South Carolina, are typically dominated by three broadly defined community

types: pocosin, pond cypress and bay forest. It is thought that these communities are shaped by complex interactions between landscape position, fire, hydrology and organic soil depth. Due to exploding development pressure in the region and their "isolated" wetland status, it is imperative that current and future research lead to an explicit understanding of the ecological factors that shape vegetation in this globally rare wetland type. For this research project we sampled nine Carolina Bays that occur within protected areas (i.e. South Carolina State Parks, Francis Marion National Forest and South Carolina Natural Heritage Preserves) throughout the northern Coastal Plain of South Carolina. A combination of ordination techniques and ANOVA are used to explore differences between community types with regards to vegetation, water chemistry, soils, evidence of fire, and landscape variables. Data presented here will provide valuable insight to conservation and restoration professionals working to manage and restore these systems and other depression wetlands throughout the southeastern United States.

- 141 MCMILLAN, BRETT A. AND FRANK P. DAY. Old Dominion University—Spatial analyses of plant assemblages and microhabitats on the pimple dunes of Virginia's barrier islands.

Pimples are short, roughly circular dunes peculiar to the barrier islands of the Delmarva Peninsula. Our research has focused on the interaction of the plant assemblages on pimples, rather than the method of their geologic formation. We have studied variability in species distribution at different 'elevations' along the pimples: at marsh level, in the thickets along the slopes, and at the xeric summits. Spatial analysis of species distribution patterns revealed random to clumped distributions for most species, but we also noted species whose distribution patterns were different in different zones of the pimples (e.g. the grass *Spartina patens*). Multivariate analysis has helped us describe suites of species that seem to be allied in the different zones, but explanation for these alliances or synergisms cannot be drawn from our results as yet. Through multivariate analysis of the interaction of plant species with environmental conditions on pimples, we have found access to fresh water to be by far the most important factor determining assemblage structure and species distribution on pimples. Other factors, such as soil nutrients or aspect, however, are also important to the distribution of some species.

- 142 STRAHL, MAYA¹, NICOLE SOPER GORDON², MARTIN CIPOLLINI¹, PATRICIA TOMLINSON¹ AND RICHARD WARE³. Berry College¹, Gustavus Adolphus College² and Georgia Botanical Society³—Vegetative survey of Martha's Meadow, an open limestone glade habitat in northwestern Georgia.

The vegetation of Martha's Meadow, a small (~1 ha) site at Berry College, Floyd County, Georgia is distinct from that of surrounding areas and appears to be a type of limestone glade community. Limestone (cedar) glades and barrens of the southeastern United States are characterized by high species richness and diversity, calcareous, limestone-based soil substrates, and approximately 23 endemic species. In order to characterize the vegetation of Martha's Meadow and to determine its affinity to other limestone-based communities, a three-year comprehensive species survey was followed by quantitative surveys in May, July, and October of 2006. A total of 192 species in 59 families were identified in the study area. 158 taxa in 46 families were found in the quantitative plot surveys, including 6 species considered rare in the state of Georgia and 24 exotic/invasive species. The most important native species were the perennial grass, *Danthonia spicata*, a southeastern sedge, *Carex cherokeensis*, and *Verbesina virginica*, which is associated with alkaline soils. *Juniperus virginiana*, a key species associated with glade communities, had significant importance values in both woody and herbaceous strata. Ordination (DECORANA) and divisive classification (TWINSPAN) methods were used to compare the community structure of this site with other open calcareous habitats throughout the southeastern and mid-western United States.

- 143 ELAM, CAITLIN E., JON M. STUCKY, THOMAS R. WENTWORTH AND JAMES D. GREGORY. North Carolina State University—A floristic inventory of Cool Springs Environmental Center, New Bern, North Carolina.

Cool Springs Environmental Education Center (CSEEC), owned by Weyerhaeuser Company, is a 680 ha protected area in Craven County, North Carolina, in the floristically rich Atlantic Coastal Plain. Agriculture and development in the region have increased the need for surveys and documentation the floristic diversity in remnant natural areas. A comprehensive inventory of the vascular flora at CSEEC has produced approximately 400 species in 100 plant families to date. This study has also documented rare plant species including the Coastal Plain endemics *Litsea aestivalis* (L.) Fern. (Pondspice) and *Solidago villosicarpa* LeBlond (Coastal goldenrod). We identified twelve distinct plant communities and their soil associations at CSEEC including the uncommon Longleaf Pine (*Pinus palustris* P. Mill) Savanna, Bald Cypress–Tupelo Gum (*Taxodium distichum* (L.) L.C. Richard–*Nyssa aquatica* L.) Swamp, a number of botanically heterogeneous small depression wetlands, and one potentially novel *Quercus hemisphaerica* Bartr. ex Willd.–*Pinus taeda* L. Woodland. The high diversity of plant communities reflects the high diversity of soil types ranging from excessively drained deep sands to large wetlands with very poorly drained organic soils. Documentation of the flora and natural communities at CSEEC will inform land management decisions and future ecological and biological studies. We are also developing a website to promote the use of CSEEC by public school students for plant oriented education projects.

- 144 MATTHEWS, ELIZABETH R.¹, ROBERT K. PEET¹, ALAN S. WEAKLEY¹ AND THOMAS R. WENTWORTH². University of North Carolina-Chapel Hill¹ and North Carolina State University²—Alluvial plant communities of Piedmont brown-water rivers.

Few pristine riparian ecosystems remain in the Southeastern U.S. While historically floodplains have been home to diverse and highly productive plant communities, many of these landscapes have been converted to agriculture, damaged by impoundments, or otherwise destroyed or degraded. Knowledge of the vegetation composition and structure of these communities can inform management decisions and future restoration projects. However, despite their ecological significance, the bottomland communities of Piedmont brown-water rivers have not been well documented and described. To expand upon our current understanding of these communities and guide future restoration, plot data were collected in the Cape Fear River basin, following the Carolina Vegetation Survey protocol. We used ordination and clustering techniques to refine and improve documentation of the brown-water riparian plant communities recognized by the N.C. Natural Heritage Program and the U.S. National Vegetation Classification. In addition, we have documented the range of environmental settings associated with these types to provide better targets for restoration activities.

- 145 KROH, GLENN C., KERI MCNEW AND JOHN E. PINDER, III. Texas Christian University—Conifer colonization of a rock fall surface in the Cascade Range of northern California.

Conifer colonization and forest development was studied on a 1650 AD rock-fall surface at Lassen Volcanic National Park in northern California. The site ranges from 1880 m to 2040 m of elevation and has a surface composed of angular blocks reaching > 0.5-m in diameter. Individuals of conifer species in fifty-three 200-m² permanent plots were sampled in 1992 and resampled in 2003. Most of the 1992 individuals were *Abies concolor*, *Pinus monticola* and *P. ponderosa* with little evidence of gradients in species occurrences with elevation. The mean density of ≥ 0.1 -m tall individuals was 725 ha⁻¹,

and densities increased with decreasing block sizes of surface materials. Mean (\pm SD) heights were 2.00 (\pm 0.90) m, and only 12 % of the trees were \geq 5-m tall. The mortality rate from 1992 to 2003 was 0.006 y^{-1} for individuals \geq 0.1-m tall and suggested mean life expectancies $> 100 \text{ y}$. Mean (\pm SD) proportional height growth rates for healthy, undamaged individuals were $0.0166 \pm 0.0159 \text{ y}^{-1}$, but damage and disease reduced the rate of increase in mean heights from 1992 to 2003 to 0.018 m y^{-1} . Current forest structure is compared to that measured on the site in the 1950s and 1960s, and forest development rates are compared to other similar debris flows and volcanic surfaces.

- 146 BALLINGER, DAVID AND GARY L. WALKER. Appalachian State University—A vegetational survey of an unclimbed cliff system at White Rocks, Cumberland Gap National Historic Park.

A vegetational survey of the White Rocks cliff system, located in the Cumberland Gap National Historical Park, was conducted from June to November of 2005, and May of 2006. Vascular plants, mosses, and lichens were surveyed on the cliff top, cliff face, and talus using 1m^2 plots spaced evenly along 11 randomly located vertical transects. Physical characteristics including transect position on the cliff, slope, aspect, feature frequency and total feature area were measured for each plot. Biotic characteristics including vascular, bryophyte and lichen species percent cover per plot, and presence or absence of each species per microhabitat were recorded for each plot. Additionally, microhabitat type including ledges, cracks and pockets, and microhabitat size were recorded for each plot. Transect and plot locations with respective biotic and abiotic features were used to construct a GIS data base of the cliff system to assess the potential impacts of rock climbing. Biotic and abiotic factors were analyzed using multivariate statistics to determine physical factors which contribute to vegetational community structure of the cliff edge, cliff face and talus. Preliminary results indicate that slope and microfeature frequency most significantly impact vegetative community structure. This project was funded by the National Park Service in conjunction with the Southern Appalachian Cooperative Ecosystem Study Unit.

- 147 BARONE, JOHN¹ AND JOVONN HILL². Columbus State University¹ and Mississippi State University²—Plant community composition and structure of remnant blackland prairies in Mississippi and Alabama.

Two centuries ago, blackland prairies were found scattered across two regions in Mississippi and Alabama: the Black Belt and the Jackson Prairie Belt. Land use changes have destroyed more than 99% of the area of these prairies. To better understand the plant composition and community structure of remnant prairies, we inventoried the grasses and forbs at 32 sites, 5 in the Jackson Prairie Belt and 27 in the Black Belt. Each site was visited monthly during the growing season for a year. A total of 193 native species were found across all the sites, with 92 species at the most diverse site. Of the variables examined, species richness was positively correlated with the size of the remnant ($r=0.410$, $P=0.034$) and the longitude of the site ($r=0.45$, $P=0.013$). Using land survey maps from the early 19th century, we also examined whether species richness of a site was related the historical size of a prairie, but there was no relationship. A cluster analysis shows that the composition of prairies in the Jackson Prairie Belt is distinctive from the Black Belt. Analysis using non-metric multidimensional scaling indicates that compositional differences across sites are related to variations in soil nutrients, particularly potassium, calcium and magnesium, as well as longitude and latitude. The results suggest that because of differences in species composition, conservation efforts need to focus on preserving remnants in both prairie regions.

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- 149 WENTWORTH, THOMAS¹, ROBERT PEET², ALAN WEAKLEY², MICHAEL LEE², FORBES BOYLE², STEVEN ROBERTS³ AND MICHAEL SCHAFALE⁴. North Carolina State University¹, University of North Carolina-Chapel Hill², North Carolina Ecosystem Enhancement Program³ and North Carolina Natural Heritage Program⁴—Application of community ordination to assessment and monitoring of ecosystem condition in restoration ecology.

The restoration of degraded ecosystems can benefit from the availability of information about reference ecosystems. Knowledge of the structure and function of high-quality, intact reference ecosystems informs restoration activities by providing explicit goals or targets for recovery of sustainable conditions. If reference ecosystems represent a range of conditions from degraded to intact, then it should also be possible to assess the current status of a degraded ecosystem and to monitor its progress toward (or away from) the desired target. Objective and quantitative tools for performing such assessment and monitoring are highly desirable. Using nonmetric multidimensional scaling (NMS), we explore the utility of community ordination procedures to (1) establish the regional framework of reference ecosystems as related to prevailing gradients of successional development and environmental conditions; (2) place restoration sites within the framework; (3) relate the initial composition of restoration sites to those of other ecosystems, including restoration targets; and (4) track “trajectories” of restoration sites through time to assess the success of restoration efforts. Monitoring data collected and maintained jointly by the Carolina Vegetation Survey and the North Carolina Ecosystem Enhancement Program are used to illustrate the utility of this approach.

Animal Ecology II

- 150 WILLSON¹, JOHN D., CHRISTOPHER T. WINNE¹, MELISSA A. PILGRIM^{1,2}, CHRISTOPHER S. ROMANEK¹ AND J. WHITFIELD GIBBONS¹. University of Georgia¹ and University of South Carolina-Upstate²—Effects of terrestrial resource pulses on trophic niche overlap between two sympatric aquatic snake species: a stable isotope approach.

Quantifying diet is essential for understanding the functional role of species with regard to energy processing, transfer, and storage within ecosystems. Recently, variance structure in the stable isotope composition of consumer tissues has been touted as a robust tool for quantifying trophic niche width, a task that has previously proven difficult due to bias in direct dietary analyses and difficulties in integrating diet composition over time. We use stable isotopes (C and N) to examine trophic niche width of two sympatric aquatic snakes, banded watersnakes (*Nerodia fasciata*) and black swamp snakes (*Seminatrix pygaea*) inhabiting a wetland where seasonal migrations of amphibian prey cause dramatic shifts in resource availability. Specifically, we characterize snake and prey isotope compositions through time, space, and ontogeny. We find that prey cluster into functional groups based on isotopic similarity and seasonal availability. Overall, isotope variance structure suggests that *Nerodia* exhibit broader (more generalist) trophic niche width relative to *Seminatrix*. Moreover, *Nerodia* exhibit temporal variation in isotope composition, suggesting seasonal diet shifts that reflect amphibian prey availability. Conversely, *Seminatrix* exhibit little temporal variation but display strong ontogenetic shifts in $\delta^{15}\text{N}$ that closely parallel ontogenetic shifts in their primary prey, aquatic salamanders. Although niche dimensions are often viewed as static, our results demonstrate that seasonal shifts in niche width and position occur in *Nerodia*, leading to temporal variation in niche overlap between the two snake species. Such short-term fluctuations in niche overlap have implications for our understanding of competitive interactions and consequently the structuring of communities and ecosystems.

- 151 PILGRIM^{1,2}, MELISSA A., CHRISTOPHER T. WINNE¹, JOHN D. WILLSON¹, CHRISTOPHER S. ROMANEK¹ AND J. WHITFIELD GIBBONS¹. Savannah River Ecology Laboratory¹ and University of South Carolina Upstate²—Expression of maternal isotopes in offspring: implications for interpreting ontogenetic shifts in isotopic composition of consumer tissues.

It has become popular to use stable isotopes as diet indicators within consumer populations. When evaluating ontogenetic shifts in isotopic composition of consumer tissues for dietary analysis, the isotopic starting point of consumers should not be ignored. Neonate isotopic composition may be very different from that of juveniles and adults; in general, their tissues are built from maternal resources rather than food resources. Thus, the isotopic variance structure of a population can be significantly impacted by consumer isotope ratios at birth. We are interested in using stable carbon and nitrogen isotopes to assess ontogenetic shifts in diet within field populations of pigmy rattlesnakes (*Sistrurus miliarius*) and black swamp snakes (*Seminatrix pygaea*). Thus, we needed to determine the degree that neonate $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values reflect maternal $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values. We housed pregnant *S. miliarius* and *S. pygaea* until parturition. We collected scale samples from females and their offspring. We quantified maternal scale tissue isotopic composition, isotopic composition of neonate scale tissue, and the degree that neonate isotopes reflected maternal isotopes. On average, neonate $\delta^{13}\text{C}$ values were depleted relative to maternal $\delta^{13}\text{C}$ values ($\approx 1\text{‰}$) and neonate $\delta^{15}\text{N}$ values were enriched relative to maternal $\delta^{15}\text{N}$ values ($\approx 1\text{‰}$). The majority of variation in offspring isotopic composition was expressed among litters ($> 95\%$ for *S. miliarius* and $> 80\%$ for *S. pygaea*). Our results suggest that highly variable isotopic signatures in young animals within field populations could easily reflect retention of a maternal signal rather than differences in resource utilization among younger snakes.

- 152 GREENBERG¹, CATHRYN H.¹, STANLEE MILLER² AND THOMAS WALDROP¹, USDA Forest Service, Southern Research Station¹ and Clemson University²—Effect of fuel reduction treatments on sorcid communities in a southern Appalachian upland hardwood forest.

As part of the multidisciplinary National Fire and Fire Surrogate Study we compared the effects of 3 fuel reduction techniques and a control on sorcid communities. Four experimental units, each $> 14\text{-ha}$ were contained within each of 3 replicate blocks at the Green River Game Land, Polk County, North Carolina. Treatments were (1) prescribed burning (B); (2) mechanical felling of shrubs and small trees (M); (3) mechanical felling + burning (MB), and; (4) controls (C). Treatments were implemented incrementally, but were complete by spring 2003. We collected shrews using drift fences with pitfall traps that were open continuously and concurrently during May – September 2003 and 2004. After treatments (2003) leaf litter depth decreased in B and MB, and snag density and light levels were highest in MB. We captured 269 shrews of 4 species, including *Blarina brevicauda* (123), *Sorex fumeus* (36), *S. hoyi* (45), and *S. longirostris* (58). Repeated measures 2-way ANOVAs indicated that total shrew capture rates were lower in 2004 than 2003, and lower in MB than other treatments. No treatment x year interaction effect was detected. Among species, *B. brevicauda*, *S. fumeus*, and *S. hoyi* capture rates were lower in 2004 than 2003, but only *S. hoyi* showed a treatment response, with fewer in MB than in M. This study will help land managers to understand what effects their fuel reduction prescriptions will likely have for shrews before implementation.

- 153 O'KELLEY JEFFREY¹ AND MARK MEADE². Jacksonville State University—A three year Ichthyofaunal Survey of Choccolocco, Shoal and Scarborough Streams in the Talladega National Forest.

Fish communities within the Talladega National Forest are a strong indicator of the quality of water and the level of human interference in the environment. Because many species can only thrive in habitats with specific water qualities, any changes in the number of species and also the number of individuals within each species in these waterways can be a useful tool in interpreting environmental changes within and around the National Forest. The humid, subtropical climate of Alabama is maintained by the state's location relative to the equator, its lack of major mountain ranges, and its distance from the Gulf of Mexico. Small changes in the communities are indicative of minor environmental changes, while major changes such as pollution and habitat interferences may result in a species being eliminated from that area. Here we report species richness, evenness and diversity indices for three streams in the Talladega National Forest. Shoal Creek had an average diversity index of 2.71 with over 506 species observed throughout the five year period with Cyprinidae, and Centrarchidae being predominant. Choccolocco Creek had an index of 2.61 with 193 total species surveyed. *Semotilus atromaculatus* was the only species recovered from Scarborough Creek. Contrary to previous reports *Etheostoma brevirostrum* was surveyed only once in Shoal Creek at Pine Glenn campground. This is the first report of species richness, evenness, and diversity from three major second order streams in the Talladega National Forest.

- 154 RAE, JOHN G. Francis Marion University—Habitat selection by benthic meiofauna in the Lynches River, South Carolina.

The physical environment of riverine sediments is well established as a heterogeneous complex of microhabitats, providing benthic invertebrates a large array of habitat choices. The objectives of this study are to examine the choices made by the major taxa of meiofauna living on a point-bar in the Lynches River, South Carolina by examination of their environment at the microhabitat scale. Detrended correspondence analysis (DCA), which indicates group associations, was performed on the 13 most abundant meiofaunal taxa. Results indicated that six taxa tended to associate closely with one another, while seven other taxa were independently distributed. Fourteen environmental variables were measured and correlated with the occurrence of these taxa. Canonical correspondence analysis (CCA) placed the distributions of these taxa on the orthogonal axes derived from the environmental parameters. The significant variables accounting for their distributions were: depth in the sediment and in the water, the shore line location from head to tail along the point-bar, and the 1 mm and 0.5 mm sediment fractions. For the first four canonical axes, the cumulative percentages of variance explained by the taxa-environment relationship were respectively: 45, 62, 77, and 85 %. Six of the seven taxa that showed independent distributions in DCA were similarly isolated in distribution as determined by CCA, suggesting the most important variables were measured.

- 155 MCCALL, AMANDA F.¹, PAUL M. STEWART¹ AND THOMAS P. SIMON². Troy University¹ and Indiana Biological Survey²—Life history of the crayfish, *Procambarus suttkusi*.

There are about 75 crayfish species in Alabama and more than half are experiencing population declines primarily due to natural range limitations and loss of habitat. Little is known about the life history of the crayfish that have been previously collected and this type of information is becoming increasingly important for crayfish conservation in the region. This study documented the reproductive life history for *Procambarus suttkusi*, a species of special concern in the Choctawhatchee and Pea Rivers watersheds of southeastern Alabama. Life history data, including documentation of size, sex, male reproductive form, and indications of female reproduction, such as presence of a sperm plug or abdominal eggs, were recorded monthly and sometimes semi-monthly, from February 2006 until February 2007, for individuals collected from the East Fork of the Choctawhatchee River. Water chemistry, habitat, and density data were collected to

provide additional information that may have affected the life cycle of this organism. Form I males were found from mid-May until mid-September, when they molted again back into the nonreproductive form. Ovigerous females were collected in June and the first of July, but presence of young of the year collected on the first of June indicated that this species may have become ovigerous as early as April or May. Sperm plugs first appeared in November and active glair glands were initially found in May. This study indicated a similar, but distinct life cycle for *P. suttkusi* compared to other *Procambarus* sp. of the southeastern United States.

- 156 CECALA, KRISTEN K., STEVEN J. PRICE AND MICHAEL E. DORCAS. Davidson College—Interspecific interactions among stream salamanders: Integrating laboratory and field studies.

Predation plays an important role in structuring community composition and relative abundance of salamanders within stream ecosystems. In diverse salamander guilds, predation among species may occur when size differences exist that can affect prey selection, consumption rates, and microhabitat use. In this study, we examined the interactions between larval red salamanders (*Pseudotriton ruber*), and larval northern dusky salamanders (*Desmognathus fuscus*) in both laboratory and field settings. Specifically, we 1) examined the behavior and microhabitat use of larval *D. fuscus* to response to the presence of *P. ruber* in the laboratory, 2) investigated actual predation on *D. fuscus* by examining the diet of *P. ruber* in the field, and 3) analyzed the effect of *P. ruber* presence on the abundance of larval *D. fuscus* in streams. In the laboratory, we found that larval *D. fuscus* chose cover objects further from a potential predator (i.e., *P. ruber*) than from a conspecific ($p = <0.001$) and would frequently leave the water in their larval state to avoid a predator. However, in the field we found that salamanders comprised only 2.5% of the diet of *P. ruber*. Yet, we captured significantly fewer *D. fuscus* in streams where *P. ruber* were present ($p = 0.048$). Our data suggest that the threat of predation, even if actual predation rates are low, can lead to changes in the behavior of prey species. Ultimately, the threat of predation may alter prey species abundances and community compositions in stream systems.

- 157 MCCALL, AMANDA F.¹, PAUL M. STEWART¹ AND THOMAS P. SIMON². Troy University¹ and Indiana Biological Survey²—Aggressive interactions among Form I and Form II males of the crayfish, *Procambarus suttkusi*.

Crustaceans compete for resources using aggressive interactions, often termed agonistic interactions. Hierarchical relationships are formed, giving the organism with the higher rank access to the best resources, such as shelter, reproductive success, and feeding area. This study focused on the intraspecific agonistic behavior of *Procambarus suttkusi*, a species widely distributed in the Choctawhatchee and Pea Rivers watersheds of southeastern Alabama. Aggressive behaviors for three types of interactions between two morphologically distinct size-matched male types were documented to identify the overall winners of agonistic interactions between each reproductive type and quantify differences among the initiation behaviors used by the winners and losers of these interactions. These same pairs of individuals competed for food in another trial to see if the winners of the agonistic interaction would also win the feeding competition. Twenty Form II versus Form II, 16 Form I versus Form I, and 13 Form I versus Form II interactions were observed. There were no significant differences found among the initiation behaviors used by winners and losers in these interactions. When paired together, Form I males did not significantly win more interactions than did Form II males. In all three types of interactions, however, the overall winners won significantly more feeding contests than the overall losers. This study showed that Form I males of this species do not dominant size matched Form II males and individuals capable of winning agonistic interactions dominate valuable food resources used by these organisms.

- 158 TODD, BRIAN D. AND ANDREW K. DAVIS. University of Georgia—Sexual dimorphism in coloration of the marbled salamander, *Ambystoma opacum*, with correlations to body size and condition.

Many animal species exhibit conspicuous sexual dimorphism in secondary characters which are attributed to sexual selection. In this paper, we used image analysis techniques to examine sexual dimorphism in the coloration of marbled salamanders, *Ambystoma opacum*. Marbled salamanders are the only ambystomatids that mate and oviposit terrestrially on rainy nights and exhibit parental investment in egg clutches in the form of maternal nest brooding. They are also the only ambystomatid suspected of having sexually dimorphic coloration. We measured the average brightness of white pigment on salamanders as well as the proportion of white dorsal surface area relative to black. Males had significantly brighter white cross-bandings and higher relative proportions of white coloration on their dorsal surfaces than did females. Additionally, the relative proportion of white on the dorsum was correlated to body condition in both males and females, with heavier animals producing more white pigment on the dorsum relative to the black background. We propose that the sexually dimorphic coloration that we report in *A. opacum* may be a sexually selected trait and that *A. opacum* represents a novel study system that warrants additional research on mate recognition and mate choice.

- 159 BROWN, CHRISTOPHER G. AND DANIEL J. FUNK. Vanderbilt University—Do trichome-covered fecal cases protect *Neochlamisus* leaf beetle larvae (Coleoptera: Chrysomelidae) from arthropod predators? A test of multiple mechanisms using *N. platani*.

Camptosomate leaf beetles share an amazing building behavior in which female beetles wrap their eggs in plates of fecal material forming a case. The larvae remain in this case, carrying it over their backs and enlarging and elaborating it until pupation. This study is the first fully detailed study that evaluates the adaptive function provided by the fecal cases of this group. The cases of one camptosomate in particular, *Neochlamisus platani*, contain architectural aspects not normally found in other beetles, i.e. incorporation of trichomes into the outside of the case and trichomes stored in a special compartment within the case, the "trichome attic" (currently only known in this species). The objectives of this study are to determine whether or not the unique aspects of animal architecture found in *N. platani* cases individually or in combination provide protection from arthropod predators using multiple generalist predators of different orders and feeding habits. Continuous observation trials allow the evaluation and recording of a range of mechanisms and behaviors associated with this fascinating example of animal architecture that contribute to the survival of *N. platani* larvae.

Aquatic, Wetland and Marine Management I

- 160 CIAK, CATHERINE E., ROBERT U. FISCHER, CHARLES L. PEDERSON AND JAMES M. NOVAK. Eastern Illinois University—Extreme flow events affect benthic macroinvertebrate assemblages in the Sangamon River, Decatur, IL.

Dams significantly influence exerted downstream biota, specifically macroinvertebrates by reducing seasonal flow variability and altering the timing or magnitude of extreme flow events. Macroinvertebrates often have been used as biomonitors because of their sensitivity to anthropogenically introduced changes in an aquatic environment. This study investigated the effect of altered hydrologic regime on benthic macroinvertebrate assemblages immediately downstream of the impoundment. The study was conducted in the stream reach of the Sangamon River in Decatur, Illinois starting below the Lake Decatur dam. Four sites were established and sampling took place at base flow

conditions, before and after an extremely high flow (in excess of 2000 ft³/sec). The EPA 20 Jab Method was used to collect samples. Collections were taken back to the lab and were sorted and identified to family. ANOVA revealed significant differences in mean macroinvertebrate family richness and Shannon-Wiener diversity for all dates by sampling sites. There also was a significant difference in Shannon-Wiener diversity between pre- and post-disturbance by sampling date. We also used multidimensional scaling to identify those taxa which are tolerant of sensitive to altered flow regime and to investigate which taxa are more capable of recolonization after hydrologic disturbance.

- 161 GERBER, JAY P., CHARLES L. PEDERSON AND ROBERT U. FISCHER. Eastern Illinois University—Impacts of reservoir and sanitary district discharges on stream community metabolism.

We studied an urban reach of the Sangamon River extending downstream from the dam which impounds Lake Decatur. Based on macroinvertebrate and fish indices of biotic integrity, a significant improvement in stream habitat quality was observed in the Sangamon River downstream from the discharge of the Sanitary District of Decatur (SDD) when compared to that reach which extends upstream to the dam. Physical and chemical variables indicated that overall habitat quality may be improved by predictable instream flows derived from sanitary discharges when compared to the temporally variable habitat immediately downstream of the reservoir. Spatial variation of benthic algal assemblages also has been documented. Our premise is that sites downstream of SDD may have greater potential for instream net primary productivity as a result of nutrient loading while heterotrophic metabolism at upstream sites may be supported by suspended organic material including phytoplanktonic algae derived from the reservoir. We are utilizing three stream reaches, one above and one below the SDD discharge as well as one on Polecat Creek, a minimally impacted reference stream. Benthic algal standing crop, total heterotrophs, and community metabolism were found to be temporally and spatially variable. Evaluation of these results in the context of environmental heterogeneity will elucidate the relative role of instream nutrients, ambient light regime, and altered stream hydrology in determining the degree to which stream metabolism is dominated by heterotrophic and autotrophic processes.

- 162 OGASAWARA, MASAMICHI. Clemson University—Spatial analysis of herbaceous vegetation in South Carolina tidally influenced freshwater forested wetlands.

Tidal freshwater forested wetlands comprise a unique forested wetland condition because of their physiographic position of occupying low lying coastal areas where they are subjected to both upland runoff and tidal flooding. While these systems have received rather nominal scientific attention they are among the most sensitive ecosystems at risk from climate change due to sea-level rise and increased drought or flood frequency. The current study is being conducted at three tidally influenced forested wetlands sites along the Waccamaw River and Turkey Creek. Baldcypress is the dominant tree at all sites, but herbaceous vegetation differs due to variations in elevation and salinity. Two 20-m transects have been established at each of the three study sites. Plant cover was estimated for each species in 1-m² subplots along each transect. Salinity is measured monthly in two salinity wells, while water levels are monitored continuously. Elevations of each subplot were made relative to the water level gauges in each plot. Herbaceous vegetational compositional variation among sample plots was evaluated using Non-metric Multidimensional Scaling (NMS) ordination. Herb-layer composition showed clear separation of one site (Turkey Creek) from the others. Multiple response permutation procedures (MRPP) analysis found significant differences in community composition with p-value <0.001. Salinity analysis of sites using ANOVA indicated there are significant differences among sites.

- 163 TUFFORD, DANIEL L.¹, STEPHEN H. BENNETT² AND JOHN B. NELSON¹. University of South Carolina-Columbia¹ and South Carolina Department of Natural Resources²—A Descriptive Ecology of Seepage Wetlands on the South Carolina Coastal Plain.

Seepage wetlands occur at the base of slopes and bluffs at the outer edge of a floodplain or stream corridor. Unlike riverine wetlands these systems receive most of their water as groundwater discharge from adjacent upslope land. Frequently a dominant feature of the landscapes on which they occur, they may serve important roles in local and regional biodiversity, water quality, and biogeochemical cycling. This project initiated a study of the ecology of these wetlands. Initial study sites were four seeps, two in Beidler Forest in Dorchester County and two in Wannamaker Nature Preserve in Calhoun County. The sites were visited seasonally for one year to collect data on herpetofauna, flora, and water quality. Hydrologic data was collected continuously with rain gauges and water level recorders in shallow wells. Cover objects were used at each site to sample amphibians and reptiles both within the seep and in adjacent terrestrial habitat. Data reported include species composition for each seep, distribution of observations within seep, and terrestrial habitat and temporal distribution of observations. The wetlands show a strong response to precipitation events typical of that seen in headwater streams. There is also a seasonal signal seen in the hydrology and water quality data, however the amphibian assemblage remains relatively constant throughout the year. In combination the initial results suggest these ecosystems are important local habitat, in particular for species that are absent or rare in the surrounding floodplain and terrestrial habitats, and that they are sensitive to mesoscale site factors.

- 164 WITMER, PATRICK L.¹, CHRISTOPHER K. METCALF² AND PAUL M. STEWART¹. Troy University¹ and U.S. Fish and Wildlife Service²—Indexing unpaved road stream crossing conditions in the Choctawhatchee watershed: pre-implementation risk rankings.

Unpaved road stream crossings act as artificial barriers to aquatic species migration, fragment habitats, increase sediment yields in streams, and alter channel morphology and stability. Before restoration and mitigation strategies can be implemented, a priority listing of unpaved road stream crossings must be created. The objective of this study was to risk rank unpaved road stream crossings in the Choctawhatchee watershed (southeastern Alabama) based upon field reconnaissance of current sedimentation potential. Initial reconnaissance and targeting was done to identify potential sites of interest. Field surveys involved recording observations of waterway conditions, crossing structures, road approaches (distance and slope), and roadside soil erosion features at the inventoried stream crossings. Road-stream crossing risk analysis involved a model that weighed soil erodibility (K-factor), road hydrologic connectivity, road approach slopes, and potential soil erosion features. A high risk sedimentation model based on the adverse conditions identified at unpaved road stream crossings is discussed. Preliminary analysis suggests that culverts cause more sedimentation problems than bridges. The length and steepness of the approach, the absence of incremental turnouts, and lack of vegetation cover contributes to sediment risk.

- 165 RASMUSSEN, JESSICA AND CHARLES L. PEDERSON. Eastern Illinois University—A lake and reservoir index of biotic integrity: using phytoplankton assemblages for bioassessment.

The Illinois Environmental Protection Agency Bureau of Water (IEPA-BOW) has accumulated physical, chemical and biological data on more than 100 bodies of water for over 20 years under the Ambient Lakes Monitoring Program (ALMP). Most lentic systems

in Illinois are of anthropogenic origin, although a few lakes of natural origin exist. Of these lakes, approximately 75% have surface areas of less than 100 hectares and mean depths which do not exceed 5 meters. Analysis of limnological data has revealed regional differences in the physicochemical characteristics of lakes and reservoirs. These regional differences include divisions based on geomorphological and bureaucratic regions. Multidimensional scaling of phytoplankton assemblages further demonstrated significant differences among regions within the state and confirmed seasonal and interannual differences. Results from the analyses indicate that there is no significant difference between summer months when concerning phytoplankton assemblages, indicating routine sampling of Illinois lakes should occur over the summer. Lastly, further analyses have revealed that of the 124 phytoplankton genera identified from Illinois lakes, a subset of 17 phytoplankton genera are critical for discerning lake condition during summer months. We are evaluating the response of metrics based on these taxa to appropriate environmental gradients for development of a Phytoplankton Index of Biotic Integrity for use in Illinois lakes and its potential application in a broader geographic context. Results will be useful for lake and reservoir management in Illinois and nationally, since this will be among the first with major focus on reservoirs.

- 166 DIMICK, BRITTA, JANE AWL AND PATRICIA COX. Tennessee Valley Authority—Key to globally rare wetland communities In the Tennessee Valley region.

Widespread loss of wetlands has increased concern for the survival of rare wetland communities. NatureServe, an organization supported by an international network of Natural Heritage programs and Conservation Data Centres, has identified, described, and ranked types of globally rare ecological communities as: G1 = critically imperiled, G2 = imperiled, or G3 = rare or uncommon. Methods for rapid identification of rare ecological communities are needed in order to provide more consistent detection of these geographically limited natural resources, and increase opportunities for their protection and conservation. Recognizing this need, the Tennessee Valley Authority (TVA) Natural Heritage Program has developed a series of dichotomous field keys to globally rare wetland communities known or potentially existing within the Tennessee Valley region, which includes portions of Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia. A separate key is provided for each of the seven states, and subdivided by U.S. Forest Service ecoregions. Supporting County lists help users easily navigate to the appropriate ecoregion section(s) within each State. In the event that wetlands occur within a proposed project site, these keys provide a method for early determination of the presence or absence of known types of globally rare wetland communities. Consistent detection of globally rare wetland communities will allow more accurate assessments of wetland significance and mitigation options.

Invertebrate Zoology and Entomology I

- 167 DAFOE, ROBERT C. AND FRANK A. ROMANO, III. Jacksonville State University—A seasonal and transect survey of leaf litter tardigrade communities from a Gulf of Mexico barrier island (Dauphin Island, Alabama).

Dauphin Island is a barrier island in the Gulf of Mexico just south of Mobile Bay, Alabama. The remainder of the island is a narrow band of sand. Six seasonal collections (Oct. '99 – Feb. '01) were taken along 4 transects (east to west) across the island, from Bay to Gulf, through the eastern forested areas of the island to survey tardigrade communities. Within each transect samples of leaf litter (upper & lower separated) were collected. A total of 1,169 tardigrades were collected from the upper leaf litter. Seasonal samples yielded no obvious patterns. Fall samples (Oct. '99 and '00) had 123 and 382 tardigrades respectively. Winter samples (Jan. '99 and Feb. '00) yielded 89 and 301 tardigrades respectively.

respectively. Transect 1 had (eastern most transect) 3 trees sampled and produced 330 tardigrades. Transect 2 had 5 trees were sampled and produced 508 tardigrades. Transect 3 had 5 trees sampled and produced 222 tardigrades. Transect 4 had 3 trees sampled and produced 109 tardigrades. An average of 96 tardigrades were found in Gulf coast dune leaf litter. An average of 61 tardigrades were found from middle island samples and an average of 41 tardigrades were found in the Mobile Bay samples. Most tardigrades (78.8 %) were in the genus *Macrobiotus*. Others genera found were *Diphascon/Itaquascon* (9.1 %), *Hypsibius* (5.7%), *Milnesium* (4.5%), *Echiniscus* (0.76%) and *Calcarobiotus* (0.57%). Two new species of the genus *Calcarobiotus* have been tentatively identified.

- 168 ROMANO¹, FRANK A., III, MARIA GALLO², ROSSANA D'ADDABBO² AND PAUL MONTAGNA³. Jacksonville State University¹, University of Bari², Bari, Italy, and Texas A&M University-Corpus Christi³—A first look at deep-sea tardigrades in the northern Gulf of Mexico.

Benthic samples were collected (using a boxcorer) from 43 stations in the northern Gulf of Mexico during May and June 2000. The top 3cm of core samples were extruded for meiofaunal studies. Meiofauna were narcotized in MgCl₂, preserved in buffered formalin, and extracted using Ludox centrifugation. Tardigrades were separated from bulk meiofauna by manual picking. A total of 54 tardigrades were extracted from samples ranging in depth from 625m to 3150m. 35 tardigrades were mounted onto permanent glass slides (glycerol mounting medium) and identified to species using standard morphological characteristics. Only 8 tardigrades were collected from the top cm of the core, 0 from 1-2cm, and 46 from 2-3cm. Five genera of tardigrades were collected; *Angursa* (2 specimen from 1401m and 2020m), *Coronarctus* (29 specimen from 625m to 3150m), *Euclavarctus* (1 specimen from 2743m), *Proclavarctus* (1 specimen from 2600m), and *Styraconyx* (2 specimen from 1565m and 2600m). *Coronarctus* was the most prevalent genera and was represented by 3 species; *C. laubieri* (16 specimen), *C. stylisetus* (1 specimen), and *C. nuova* species (12 specimen).

- 169 MILNE, MARC A, NORMAN A GREFE, III AND DEBORAH A WALLER. Old Dominion University—Survivorship of the "Asian-tiger" mosquito (*Aedes albopictus*) in the purple pitcher plant (*Sarracenia purpurea*): more evidence of invasive mutualism.

Obligate co-evolved mutualistic interactions are often destroyed by the introduction of invasive species, but rarely is a member of that mutualism replaced by the presence of such an invasive. Here we report the niche expansion of *Aedes albopictus* into unoccupied pitchers of the carnivorous pitcher plant, *Sarracenia purpurea*, in southeastern Virginia. Larvae-containing pitchers were bagged to monitor mosquito reproduction within pitchers, and occupied pitchers were monitored for larval presence through two mosquito breeding seasons. Unopened pitchers were monitored after opening for active adult oviposition. Oviposition traps were placed near pitchers to gauge oviposition preference. *Aedes albopictus* oviposited in some carnivorous plants within a 25 m radius of the original host plant but failed to spread to other plants within the same radius. Larvae matured to adulthood in pitchers, and oviposition occurred in newly-opened as well as in decaying pitchers. Therefore, successful continued reproduction of a foreign mosquito within unoccupied pitchers of *S. purpurea* demonstrates that invasive species can invade natural communities and occupy vacant niches. The obligate mutualistic inquiline mosquito, *Wyeomyia smithii*, was not present in the pitchers at the time of oviposition by *A. albopictus*, creating an unoccupied niche available for invasion. *Aedes albopictus* is, therefore, one of the few existing examples of an invasive species forming a symbiotic relationship through the replacement of an obligate mutualist in a natural system.

- 170 TOWNSEND, VICTOR R., JR. AND DANIEL N. PROUD. Virginia Wesleyan College—Additions to the harvestmen fauna of Trinidad, W. I.

Previous studies of the harvestmen fauna of Trinidad, W. I. have revealed the occurrence of 24 species representing eight families, including the Agoristenidae (3 species), Cosmetidae (8 species), Cranidae (2 species), Manaosbiidae (2 species), Samoidae (2 species), Sclerosomatidae (5 species), Stygnidae (1 species), and Zalmoxidae (1 species). Of these taxa, only seven species are known from other areas, primarily Venezuela. Relatively little is known about the natural history or geographic distribution of most species on the island. In July-August 2005 and 2006, we visited rainforests in the Northern Range (primarily along Morne Bleu Ridge from Lalaja Trace to the summit of Mt. Aripo) and along the Northern Coast of Trinidad (adjacent to the beaches at Petite and Gran Tacarib). During these trips, we collected nearly 1,200 individual harvestmen including specimens representing 16 known species. The most abundant taxa in our collections were cosmetids (4 species), manaosbiids (2 species), and sclerosomatids (2 species). In addition, we collected two individuals (both adult males) that represent new families for the island. These individuals have initially been identified as *Stygnomma* (Stygnommatidae) and *Kimula* (Minuidae). Both families are known to occur in Venezuela as well as on other islands in the Caribbean; however, they have not been previously reported for Trinidad. Currently, we are trying to determine if these harvestmen represent new species or new localities for previously described taxa.

- 171 PROUD, DANIEL N., PHILIP ROCK AND VICTOR R. TOWNSEND, JR. Virginia Wesleyan College—Investigation of parental care and relationships between individuals within nests of cranid harvestmen from Trinidad, W.I.

In 2005, we made the first observations of the association between nymphs and adults within nests of the harvestmen, *Phareicranaus calcariferus*. Nests were located within logs or sheaths of palm fronds and generally contained 4-40 nymphs and at least one adult. In July 2006, we collected individuals from 12 nests of *P. calcariferus* and *Santinezia serratotibialis* (the other cranid species in Trinidad). In the field, we removed the adults from two nests and found that the individuals from one nest remained together (after 48 hrs), while individuals from the second nest dispersed. In addition, to assess homing ability in nymphs, we marked 4 individuals from 2 nests and released these individuals at distances of 1, 3, 5 and 10 m. After 48 hrs, we collected all harvestmen present and discovered that two of the displaced individuals had returned to the nest (one nymph returned that had been displaced 10 m). In Fall 2006, we began genetic analysis of the individuals collected from all 12 nests in an attempt to assess paternity and sibling relationships. We used PCR to amplify DNA sequences for elongation factor-1-alpha and RNA polymerase II. Using different primer combinations, we were able to differentiate nests containing *P. calcariferus* from those of *S. serratotibialis*. Presently, we are attempting to use this method to assess paternity within individual nests.

- 172 WOLFF, ROBERT. South University and Clemson University—Recovery from disturbance by orb weavers (Araneidae) at Congaree National Park.

Large orb-weaving spiders were collected along 1/2 mile of boardwalk at Congaree National Park, removing all conspicuous orb weaving spiders that occurred within distance of collection by a sweep-net. Census counts demonstrated recovery along the boardwalk where visitors observe these spiders. The population largely recovered within two weeks, though species composition was altered. *Gasteracantha* did not return while *Neoscona* increased in dominance. Though disturbance caused localized faunal changes, the impact on public viewing is considered to be minor. This study was conducted in the old-growth floodplain forest which is designated as a Wilderness Area and International Biosphere Reserve.

- 173 THIGPEN, ROBERT C., III AND ROBERT P. CREED. Appalachian State University—Technique for non-lethal stable isotope analysis of Caribbean Spiny Lobster (*Panulirus argus*) and Stone Crab (*Menippe mercenaria*).

Stable isotope analysis (SIA) is used to determine animal diets and construct food webs. Tissue sampling methodology for SIA is usually lethal to the study organism. As various species become endangered worldwide, it is important to develop non-lethal methods of sampling tissues for SIA. In crustaceans, animals are usually killed and abdominal tissue is used for SIA. We sampled abdominal tissue and tissues from other body parts (walking legs, antennae of lobsters; walking legs and claws from crabs), that can be removed without killing the animal to determine if they would produce SI signatures similar to abdominal tissue. Lobsters and crabs were collected from seagrass meadows in the vicinity of Caye Caulker, Belize during July and August of 2006. Tissue samples were taken from 10 adult lobsters and 10 crabs. For lobsters, leg tissue appears to be a good alternative to sampling abdominal tissue. For stone crabs, SI signatures of all three tissues were similar thus either claw or walking leg tissue can be used. We recommend the use of walking legs for stone crabs as this will have less effect on the crabs' ability to survive and will not affect the fishery. Our results suggest that tissue removed from other body parts of crustaceans can be used for SIA to assess diet and determine trophic level assignment.

FRIDAY, APRIL 20, 2007

AFTERNOON SESSION

Symposium III—Status of the Herbarium Cyberinfrastructure in the Southeast

- 174 MURRELL, ZACK E. AND DERICK POINDEXTER. Appalachian State University—SERNEC: a regional network of herbarium curators.

SERNEC (SouthEast Regional Network of Expertise and Collections) is a five-year project funded by the National Science Foundation (NSF) to develop a network of herbaria in the Southeast. This network is designed to encourage cooperation in databasing collections by the year 2020, while at the same time developing herbaria as community centers for learning about plants. SERNEC is funded as a Research Coordination Network (RCN) and the funds are to be used to facilitate development of this "virtual community" of curators, associated scientists and educators. SERNEC is partnering with the US Geological Survey's Southern Appalachian Information Node (SAIN) of the National Biological Information Infrastructure (NBII) and the University of Tennessee-Knoxville's SunSITE to provide the technological infrastructure to facilitate development of this "virtual community" through the use of interactive websites, listservs and other means to encourage communication. This symposium is a "kick-off" for a SERNEC sponsored workshop and is designed to provide time for representatives to present projects and ongoing efforts from each state in the region. It is expected that many of the ongoing projects and activities presented in this symposium, such as interactions with university libraries, education and outreach activities, and funding initiatives, are transferable to other states and regions of the Southeast. By providing a forum for the dissemination of this information, we are building the foundation of this virtual community of curators, while at the same time providing information that can be used to enhance the ongoing scientific and educational efforts of this group.

- 175 MAST, AUSTIN AND GIL NELSON. Department of Biological Science, Florida State University—The deep south plant specimen imaging project.

Stretching across five states from the Florida panhandle to eastern Louisiana, the East Gulf Coastal Plain (EGCP) ecoregion is one of the top six biodiversity hotspots in the United States. It is home to 2,864 native plant species; 125 taxa, including the white-top pitcher plant and Florida yew, are found in the EGCP and nowhere else. Despite the uniqueness of the biota and its precarious state, the region has been virtually ignored in biodiversity informatics initiatives when compared with the attention garnered by other biodiversity hotspots (e.g., those in the California Floristic Province). The 11-institution Deep South Plant Specimen Imaging Project (DSPSIP) was designed during a 2-day workshop at Florida State University in 2005 to jump-start the construction of biodiversity informatics content across the region. Specifically, the DSPSIP will (1) digitally image 290,000 specimens from the EGCP and adjacent areas, (2) use Optical Character Recognition on the specimen images and parse the text into Darwin Core v1.2 elements using the HERBarium Information System, (3) proofread the automatically parsed data, (4) submit the images to the open web image repository MorphBank (www.morphbank.net) and generate Life Science Identifiers (LSIDs) for the images, (5) migrate images, associated metadata, and LSIDs back to participating herbaria, and (6) develop web interfaces for data description to set new collecting and research priorities (e.g., by mapping sampling intensities across counties) and improve data quality (e.g., by finding incongruities in the determination of duplicates at multiple herbaria).

- 176 HANSEN, CURTIS J.¹ AND DANIEL D. SPAULDING². Auburn University¹ and Anniston Museum of Natural History²—The Alabama Flora Committee: a botanical collaborative.

Beginning in December 2001 and continuing to the present time, members of the Alabama Flora Committee have met on a quarterly basis to compile a vouchered checklist of vascular plants for Alabama. Starting with representatives from 4 major in-state herbaria, Auburn University, Jacksonville State University, Troy University, and the University of Alabama, the Flora Committee quickly expanded to include individuals representing Vanderbilt University, University of South Alabama, University of West Alabama, and the Anniston Museum of Natural History. Additionally, individuals representing more than 16 academic, governmental, and private companies from Alabama and four other states have supplied critical input on this project. Currently, the checklist is about 70 percent finished. Having completed the ferns, fern allies, gymnosperms, and monocots, the committee is now well into the dicot families. Simultaneously to working on the checklist, county-level distribution data are being gathered to create a plant atlas which will be made available online upon completion. This multi-year effort has not only advanced botanical research and knowledge of this state's flora, but also has opened doors to collaborative field work, publications, networking opportunities, and developed unprecedented camaraderie among botanists in Alabama and neighboring states.

- 177 JOHNSON, GEORGE P.¹ AND JOHNNIE L. GENTRY². Arkansas Tech University¹ and University of Arkansas-Fayetteville²—The Arkansas Vascular Flora Project and the Arkansas Herbarium Network: The flora, the database, and education and outreach programs.

The Arkansas Vascular Flora Committee (AVFC) was organized in 1999 to provide direction and coordination for the Arkansas Vascular Flora Project. The ultimate goal of the AVFC is to publish a definitive treatment of the vascular flora of the state. The *Checklist of the Vascular Plants of Arkansas* published in 2006 is the initial step toward publication of the state's first vascular flora. The Checklist will be followed by the publication of the *Atlas of the Vascular Plants of Arkansas*, which will provide county-level

distribution maps for each taxon in the state. In addition, each taxon published in the Atlas will appear with the citation of a voucher specimen including collector, collector number, county, and herbarium designation. The *Checklist* and *Atlas* will serve as a foundation of information for the treatment of Arkansas' vascular flora—*The Manual of the Vascular Plants of Arkansas*. Current efforts are focused on producing the *Atlas*, data basing specimens deposited within the state's herbaria, and writing manuscript for a Manual of all vascular plants. Other Committee activities include promoting an awareness of the Arkansas Flora Project to the community at large, offering educational programs and workshops, sponsoring botanical conferences and symposia, submitting grant proposals, producing field manuals (*Ferns and Fern Allies of Arkansas* and *Orchids of Arkansas* are in preparation) and continuing stewardship relationships with potential donors to the Project.

178 WEEKS, ANDREA. George Mason University—Virginia herbarium and library network.

The infrastructure for botanical research within the Commonwealth of Virginia has recently been revitalized by a number of independently led projects. The Digital Atlas of Virginia came online in 2005 after nearly five years of development by the Virginia Botanical Associates. The Flora of Virginia project, led by the Virginia Natural Heritage Program, is moving forward and anticipates a 2009 publication date. This will provide professional, amateur and student botanists with the first comprehensive state flora in over 300 years. At the University of Virginia, individuals from the Mountain Lake Biological Station, the Brown Science and Engineering Library and Rare Materials Digital Services have formed a productive working group to database and image the MLBS collection. In light of these advances, all 26 Virginia herbaria were invited to Charlottesville in January 2007 to discuss shared interests, challenges, and possible collaborative ventures. This presentation will summarize the holdings of these collections and report on the outcome of the Charlottesville meeting.

179 LONG, GERALD W. Francis Marion University—The Consortium of South Carolina Herbaria.

The Consortium of South Carolina Herbaria was created as an adjunct to the Society of Herbarium Curators. Membership is free and open to all South Carolina herbaria. At present, there are six herbaria in the consortium. The general secretary maintains membership roles and is developing a database of the mission statements, types of holdings and general information on the member herbaria. The general secretary will also serve as a conduit for information and communication among the members.

180 ZJHRA, MICHELLE L. Georgia Southern University—Georgia Southern University herbarium: Progress and problems.

The Georgia Southern Herbarium has approximately 20,000 accessioned, mounted specimens and 15,000 unmounted specimens. This collection is primarily from the Atlantic Coastal Plain of Georgia. Over the past 3 years we have worked energetically at determining the state of the collection in order to formulate a plan for its enhancement and broader dissemination. Through Catalyst, PRISM and Service funding over 15,000 specimens have been inventoried to date. Cabinets have been cleaned of naphthalene and a regular freezing and monitoring regiment initiated. The second phase – GIS referencing the collection – is beginning fall 2007. In collaboration with local teachers, we are currently creating curriculum that links the Coastal Plains to K-12 classroom activities and curricula. This will be accessible via the Herbarium website. Our biggest obstacles are lack of institutional support in terms of no rooms, staff, or release time allocated toward supporting the collection. Additionally, the backlog of unmounted material requires

painstaking detective efforts to match specimens to collection data. The biggest asset of our collection is that the specimens are in superb condition.

- 181 JONES, RONALD K¹. AND RALPH L. THOMPSON². Eastern Kentucky University¹ and Berea College²—Status of Kentucky Herbaria in 2006.

A recent survey of 12 Kentucky herbaria revealed 338,100 vascular and nonvascular specimens. This number is an increase of 92,000 in the last 10 years. A total of 324,700 are vascular plant specimens and 13,400 are nonvascular plant specimens. Collections at the five regional universities totaled 231,500 (68% of the Kentucky total) while those at private institutions numbered 26,300 (8%). The two facilities at the University of Kentucky accounted for 80,300 (24%). Over the last decade the number of herbaria actively engaged in databasing has increased from two to four. Databases with floristic information are maintained on websites at Murray State University, Western Kentucky University, and Eastern Kentucky University. Currently 75,900 specimens have been databased in Kentucky. One herbarium (Davies Herbarium at the University of Louisville) of the 13 herbaria listed in 1995 has closed down in the last decade with most of its collections being transferred to Western Kentucky University. Botany professors with curatorial duties have been hired at seven of the twelve institutions since 1995. A 20-year update of "the reference literature of field botany in Kentucky" is nearly complete.

- 182 SASEK, THOMAS W. University of Louisiana at Monroe—Status of Louisiana herbaria.

There are a 14 herbaria in Louisiana affiliated with SERNEC (LAF, LSU, LSUM, LSUS, LTU, MCN, NATC, NLU, NO, NOLS, SELU, SFRP, THIB, USLH). The largest collection is located at the University of Louisiana at Monroe (NLU) with 472,000 specimens representing more than 99% of the state's flora. Four other universities contain collections of over 100,000 specimens each: Louisiana State University, Louisiana Tech University, Tulane University, and the University of Louisiana at Lafayette. The remaining collections are 30,000 specimens each or less. The only herbarium that has made significant progress in developing an online, searchable electronic database is LSU, with approximately 80,000 records. Many of these records have also been assigned geographic coordinates. NLU has about 20% of its Louisiana specimens in a searchable, online database but does not include details of the collection site nor geographic coordinates. NLU is attempting to obtain funding to image and georeference its collection to create an online portal. LSU is a major participant in the Deep South eFlora project involving several southeastern states, while other Louisiana herbaria with relevant specimens are cooperating. Under SERNEC guidance, preliminary discussions are being initiated to develop a network of the Louisiana herbaria to improve communication, cooperation, and eventual integration into regional and national networks.

- 183 MCCOOK, LUCILE M. University of Mississippi—State of Mississippi herbaria.

Mississippi has seven active public herbaria, ranging in size from 12,000 to over 70,000 specimens, and all emphasize the vascular flora of Mississippi and adjacent states. Four are located in university departments of biology (DSC, MISS, MISSA, USMS), one is part of a state natural science/heritage museum (MMNS), and one is associated with a federal weed science laboratory (SWSL). The last (HGCRL) was part of a state university's coastal research station, but was severely damaged by Hurricane Katrina and is now dispersed to several regional herbaria for conservation. The largest herbarium in the state, IBE, is privately owned and has over 250,000 specimens from Mississippi and the Gulf Coast, Peru, and other parts of the world. Databasing efforts vary among these eight herbaria from none to complete. Several recent cooperative initiatives, funded by the National Science Foundation and United States Department of Agriculture are promoting

the digitization of herbarium data and images, and allowing Mississippi herbaria to share information and effort with herbaria in neighboring states.

- 184 SHAW, JOEY, RYAN MILLER, AND ANDREW CARROLL. University of Tennessee at Chattanooga—The development of a real-time, GIS-based interface for geographically displaying information inherent in herbarium data.

The digitization effort of workers at the University of Tennessee at Chattanooga herbarium (UCHT) will serve as a pilot study for NBII-SAIN/SERNEC toward the goal of a database accessible via a dynamic website. The 12,000+ UCHT specimens were databased in three semesters using five Independent Study students per semester. Once the data were digitized the focus of our work shifted toward the creation of a dynamic online interface that allows for queries on any data present in a herbarium collection. Types of data that may be queried include the general data contained on a specimen's label and also the data available from the specimen itself; for example, reproductive stage and sex if dioecious. We have recently begun scanning each specimen to create an image file that will also be available through the web interface. In addition to simply generating real-time county distribution maps the website will also allow for queries of other DarwinCore fields including reproductive stage, date, elevation, and collector. Complex queries can also be made; for example, users can search for the dates that given species have flowered within a geopolitical boundary or from what locations a plant species had been collected prior to a given date. Currently, efforts are being made toward the goal of combining the available SERNEC datasets to create and expand a single database for SERNEC. The significance of this work is to increase access of herbarium information of the southeast in a unified database that also separately recognizes contributions made by individual institutions.

- 185 KRINGS, ALEXANDER. North Carolina State University—State of North Carolina herbaria.

A summary of North Carolina herbaria and their projects will be given, with emphasis on collaborations, web resources, and education outreach activities.

- 186 ROBERTS, ROLAND P¹. AND ROBERT F. C. NACZI². Towson University¹ and Delaware State University²—Research and teaching using herbarium collections in Maryland and Delaware.

The herbaria in Maryland (BALT, MARY, SUHC) report over 120,000 specimens of vascular plants, Bryophytes, and Lichens. The Delaware collection (ca. 150,000 specimens) has been consolidated at Delaware State University (DOV). Unlike the Maryland collection, a fulltime staff manages the collection at DOV. At most institutions the collections are used as an integral part of teaching both methods of plant identification and curatorial skills. In addition, the collections are used for research. Several accessions in the BALT were used in the treatment of Asteraceae for Flora of North America and we are currently working on the treatment of *Chrysothamnus*, *Ericameria* and *Lorandersonia* for the Four Corners Flora Project. Also, research loans were made to several institutions. Of note was the loan of the E. Fisher collection to the Missouri Botanical Garden Herbarium for use in preparation of Northeastern Bryophyte treatment. Also, DOV serves as the repository for hundreds of specimens consulted for preparation of descriptions and illustrations for Flora of North America vol. 23 (Cyperaceae). Presently there are no active projects focused on databasing the collections at any of these herbaria. To a large extent, activity of the collections is dependent on the availability of staff and volunteers factors that are tightly linked to the availability of funding.

- 187 NESOM, GUY. Botanical Research Institute of Texas—Status of BRIT, other Texas herbaria, and TORCH.

The BRIT Herbarium (BRIT-SMU-VDB; total of ca. 1 million specimens) is particularly strong in collections from Texas, Oklahoma, Arkansas, and Louisiana. The VDB Collection (ca. 400,000 specimens), which is housed under BRIT aegis but filed separately, has superlative representation from Tennessee and Alabama. Mississippi is not well represented in either herbarium. An estimated 600,000 collections are from these seven states are available in the combined BRIT-VDB collection -- studies of the taxonomy and distribution of Gulf Coast species are highly efficient when begun at this institution. With BRIT, TEX, TAMU, and OKL as chief organizers, and participants from 21 other institutions, the Texas Oklahoma Regional Consortium of Herbaria (TORCH), has formed to represent and coordinate the herbaria of these two states. Since significant areas of Texas and Oklahoma are covered by the western margin of the Eastern Deciduous Forest, TORCH probably is the organization with closest floristic similarity to SERNEC.

Plant Systematics III

- 188 MUSSELMAN, LYTTON JOHN¹, REBECCA D. BRAY¹ AND W. CARL TAYLOR². Old Dominion University¹, and National Science Foundation²—The genus *Isoetes* (Lycophyta) in the Southeastern United States.

We review the current knowledge of distribution, taxonomy, and evolution of quillworts (*Isoetes* spp.) in the southeastern U.S. based on research over the past twenty years. Quillworts are remarkably diverse in the southeastern U.S. with more taxa than in any other comparably sized part of the World. Morphological, cytological, and molecular evidence indicates that species include eight basic diploids [$2n=22$] (*I. butleri*, *I. engelmannii*, *I. flaccida*, *I. mattaponica*, *I. melanopoda*, *I. melanospora*, *I. tegetiformans*, *I. valida*); seven allotetraploids [$2n=44$] (*I. acadiensis*, *I. appalachiana*, *I. hyemalis*, *I. louisianensis*, *I. piedmontana*, *I. riparia*, *I. virginica*); three allohexaploids [$2n=66$] (*I. georgiana*, *I. junciformis*, *I. microvela*), one allooctoploid [$2n=88$] (*I. tennesseensis*); and one allodecaploid [$2n=110$] (*I. lacustris*). In addition, there are four named primary hybrids (*I. × altonharvillii*, *I. × brittonii*, *I. × bruntonii*, *I. × carltaylori*). Both diploid and tetraploid forms of *I. piedmontana* have been reported. Several new taxa still remain to be named. Until we understand their phylogeny, we are reluctant to accord a formal taxonomy to several undescribed polyploid taxa as they may be polyphyletic. Quillworts are generally promiscuous and interspecific hybrids are common and identifiable by their production of polymorphic megaspores. Asexual reproduction may play a larger role in reproduction than generally realized. Despite significant advances in understanding their phylogeny and diversity, quillworts remain overlooked, understudied, and challenging to those wanting to make field identifications.

189 CANCELED

- 190 ALLISON, JAMES R. Rutledge, Georgia—The five species of the *Hypericum denticulatum* complex.

Among herbaceous species of *Hypericum* L. with surficially punctate-glandular foliage and quadrate, narrowly winged stems, the *Hypericum denticulatum* complex (of southeastern U.S.A. and sparingly beyond) comprises five glabrous species with several additional shared character-states, including petals orangish-yellow, strongly inequilateral, ca. 1 cm long by 0.5 cm wide, and apiculate (the "*denticulus*"); stamens numerous (50–80); and styles comparatively long (2–4 mm). Three taxa are obligate wetland plants: *H. denticulatum* Walt., *H. harperi* R. Keller, and *H. erythraeae* (Spach) Steud., the latter newly recognized, with application of the name confirmed by examination of the type, at the National Herbarium of France (P). A relatively tall species of bogs on the Atlantic

Coastal Plain of Georgia and South Carolina, *Hypericum erythraeae* is distinguished by leaves appressed or ascending, lanceolate, distinctly reduced upward, and relatively sparse (<7 nodes in the 15 cm below the primary inflorescence). *Hypericum virgatum* Lam. and *H. radfordiorum* Weakley ex J.R. Allison, sp. nov., are obligate upland plants, the latter endemic to granitic outcrops in or near the Brushy Mountains (upper western Piedmont of North Carolina). *Hypericum radfordiorum* resembles *H. virgatum* in having leaves (when dried) with upper surfaces less conspicuously glandular-punctate than the lower, and by some of the larger leaves with pinnate veins in the distal half, but differs in having leaves more acuminate and distinctly longer (longest >3 cm), and by (dried) stems copiously glandular-punctate, with usually several of the upper leaf axils producing flowering branches bearing only moderately reduced leaves (longer than their internodes).

- 191 SMITH, GERALD L.¹ AND MARK A. GARLAND². High Point University¹ and Scientific Latin Translations²—Unusual populations of *Hymenocallis* in the Florida Panhandle.

The taxonomy of the US southeastern spider-lilies continues to offer challenges in identification of herbarium specimens and native populations to the authors. The treatment of *Hymenocallis* presented in the *Flora of North America* (2002) defined 15 species concepts and a nomenclatural paper in *Taxon* (2003) provided the types for the names of those species. In late spring of 2004, the authors began critically reexamining puzzling populations deep in the Apalachicola National Forest of the Florida Panhandle. The authors revisited those populations in spring of 2005 and were fortunate to find them at peak anthesis. The senior author and botanical associates did a follow-up study in spring of 2006. Our field and herbarium studies reveal that these populations have a distinctive morphology as compared to any known southeastern spider-lily species. Supporting the morphological distinctions is a distinctive karyotype. The authors conclude that these unique populations should be described as a new spider-lily species.

- 192 GOODWILLIE, CAROL AND BRIAN BURNE. East Carolina University—The genetic architecture of variation in the timing of self-compatibility in *Leptosiphon jepsonii*.

The factors that drive the evolutionary dynamics and maintenance of mixed mating systems in plants remain elusive despite longstanding theoretical interest. The genetic basis of traits that determine the extent of self- vs. cross-fertilization can affect the outcome of selection on the mating system. Here we investigate the genetic architecture of variation in self-incompatibility in the California North Coast Range narrow endemic, *Leptosiphon jepsonii*. Some individuals exhibit a floral age-dependent form of self-incompatibility that promotes cross-fertilization and delays selfing, while others self-fertilize upon flower opening. The development of true breeding early and delayed selfing lines from three populations demonstrated that variation in the timing of self-compatibility is largely genetically based. Early and late selfing lines were crossed to create F₁ and F₂ progeny from each population, and the timing of self-compatibility was assayed by counting pollen tubes in flowers that were self-pollinated upon opening. In all populations, F₁ progeny were found to produce few self pollen tubes, indicating that early selfing is largely recessive. Comparison of variance in pollen tube number in F₁ and F₂ progeny revealed that relatively few genes control this variation. When early selfing lines from the three populations were crossed in a complementation test, delayed selfing was restored in two out of three crosses, suggesting that different functional genes are responsible for early selfing in different populations. This finding highlights that parallel and independent evolution of the mating system is occurring within populations of the species at a small geographic scale.

- 193 FLAGG, RAYMOND O.¹ AND GERALD L. SMITH². Carolina Biological Supply Company¹ and High Point University²—Nomenclatural problems in Mexican Rain-lilies.

Problems with applications of both generic and species names of rain-lilies arose in the early 19th century and continue today. This is now especially evident in Mexico with *Cooperia*, *Habranthus* and *Zephyranthes*. Recent DNA studies by Alan Meerow indicate that *Habranthus* comprises one clade and that traditional *Zephyranthes* sorts out into two clades. The clade of particular interest to our study is primarily of Mexican and southwestern US taxa and includes traditional *Cooperia* species. Less than 20 years ago, Rogers McVaugh included Mexican *Habranthus* species in *Zephyranthes*. We believe that *Habranthus* species with stamens of 4 lengths can be distinguished (as we did in *Flora of North America*) from *Zephyranthes* and *Cooperia* species with stamens of 2 lengths, but which might appear equal in length in some species. In *Flora of North America* we included *Cooperia* in *Zephyranthes* because 4 distinct "species" in 3 separate localities are clearly natural hybrids between yellow-flowered *Zephyranthes* and the type species of *Cooperia* (*C. drummondii* Herbert [1836], *Z. chlorosolen* [Herb.] D. Dietrich [1840]). If Meerow's SW US-Mexican clade is distinct from other *Zephyranthes*, that clade would be *Cooperia*. What apart from DNA and geography would distinguish *Cooperia* and *Zephyranthes*? If there are distinguishing morphological characteristics, can they be seen in herbarium specimens? At the species level some old valid names have fallen into disuse in favor of later synonyms; e.g., *Z. grahamiana* Herb. (1837) = *Z. fosteri* Traub (1941), and *Z. lindleyana* Herb. (1837) = *Z. clintiae* Traub (1952).

- 194 MAST, AUSTIN, FREDRIK RONQUIST, GREG RICCARDI, GREG ERICKSON, CORINNE JÖRGENSEN, PETER JÖRGENSEN, ROBERT VAN ENGELN, DAVID GAITROS, NEELIMA JAMMINGUMPULA, KATJA SELTMANN, ANDY DEANS, KAROLINA MANEVA-JAKIMOSKA, STEVE WINNER, WILREDO BLANCO, DEBORAH PAUL, CYNTHIA GAITROS, KEN MORIUCHI, JANET CAPPS AND ALBERT PRIETO-MARQUEZ. Florida State University—MorphBank: An open web repository for biological images.

Many biological disciplines draw important conclusions from images. These disciplines include comparative morphology, anatomy, and histology, morphological phylogenetics, taxonomy, and paleobiology. However, the majority of these images cannot be published due to page constraints in journals, and thus they are not widely available. MorphBank (www.morphbank.net) is for these images what GenBank is for genetic data – a persistent, easily accessed storehouse with added functionality tailored to the disciplines using the resource. Following an introduction to MorphBank, we will focus on new functionality that has been recently added for collaborative morphological phylogenetics and the remote annotation of natural history specimens by experts.

- 195 CHANDLER, GREGORY T. University of North Carolina Wilmington—Interactive, digital keys: modern electronica or useful diagnostic tools?

All taxonomists rely on keys, either using and/or writing them. Students and amateurs alike often struggle through keys, seeing them as obstacles that need to be overcome. As our taxonomic knowledge increases, so keys become easier to use, and a real sense of accomplishment is achieved by a successful day's keying. Some keys, though, seem to remain personal bugbears. For example, many find Asteraceae or Cyperaceae keys in plants overly difficult, with my own being the key to Australian flies. This leads to poor identifications—how many *Aster* sp., *Carex* sp. or *Musca* sp. do you have in your collection? Until quite recently the written, dichotomous key was the staple for identification purposes, many of which are written by experts for experts, and rely on taxon-specific morphological character sets. Without flowers, for example, you will

struggle to get through the Asteraceae key, yet without fruit, you will fail in Cyperaceae. Electronic keys provide a mechanism that allows for an easier experience when identifying organisms, particularly those with which you are poorly acquainted. There are no couplets—the user simply picks those characters they can utilize, in no particular order. From there, they can attempt more difficult characters as prioritized by the program to minimize the number of steps required, with pictures and descriptions built-in for each character. Such keys can be written for a large group of organisms or a geographic area, and represent a powerful identification tool that we should utilize. After all, we are all still students!

- 196 MILLER, RYAN, JOEY SHAW AND ANDREW CARROLL. University of Tennessee-Chattanooga—The development and GIS applications of a dynamic online herbarium dataset.

The ongoing digitization effort of workers at the University of Tennessee at Chattanooga herbarium (UCHT) is to serve as a pilot study for SAIN/SERNEC in order to evaluate database issues involving DiGIR's Darwin Core standards, techniques of georeferencing, and dynamic website development utilizing Geographic Information Systems (GIS). The 12,000 specimens of UCHT were databased via the latest Darwin Core standard and uploaded onto SDE and SQL servers hosted by UT-Knoxville's SunSITE infrastructure. In order to establish the most efficient and accurate means of generating geographic coordinates for specimens lacking this information we compared two different georeferencing software packages (GEOLocate & BioGeomancer). In addition, a major contribution to the SERNEC/NBII partnership was the creation of a dynamic online interface that allows for county distribution maps to be created using the specimen information contained within the UCHT database. The website will also allow for queries on other kinds of information contained in the Darwin Core standardized database including reproductive stage, geographic coordinates, elevation and collector. Complex queries can also be made; for example, users can search for the dates that given species have flowered within specific counties. Currently, efforts are being made toward the goal of combining all available SERNEC datasets (thus far data are available from UCHT, NCU, NCSC, MISS, TROY, EKY, TENN Ferns) in order to create and expand a single database for SERNEC. The significance of this work is to increase access of herbarium information of the southeast to the greater scientific community, educators, general public and government agencies.

197 CANCELED

- 197B MORRIS, J. CLAY, GREGORY T. CHANDLER, AND STEVEN BREWER. University of North Carolina Wilmington—A floristic survey of the Boiling Springs Lakes Preserve in Brunswick County, North Carolina.

This floristic survey of the Boiling Springs Lakes Preserve will provide a comprehensive inventory of the flora for this nationally significant ecological area. An unusual combination of geologic and geographic features has resulted in a mosaic of threatened habitats, many of which are unique to the southeastern Coastal Plain. Carolina bays, pine savannahs, and coastal fringe sand-hills are present within the Preserve, as well as the largest known concentration of lime-sink depression ponds. These various ecosystems have resulted in the highest concentration of rare plants in North Carolina. Such species include federally designated *Dionea muscipula*, *Lysimachia asperulifolia*, and *Solidago pulchra*. State designated species, such as *Platanthera integra*, *Agalinis linifolia*, and *Peltandra sagittifolia* have also been recorded within the site. In addition, the establishment of long-term monitoring plots in a now-defunct loblolly pine plantation on the Preserve will provide baseline information to follow the progress of long-leaf pine restoration efforts.

Herpetology II

- 198 VIERNUM, SARA E., BENJIE BLAIR AND GEORGE CLINE. Jacksonville State University—*Aeromonas hydrophila* skin infections in the green salamander, *Aneides aeneus*, from Northeastern Alabama.

Aneides aeneus, the subject of a natural history study in Northeastern Alabama, is a state listed Species of High Concern (S2). In 2005, individuals at three study sites were observed having a series of red spots on their bodies. Upon closer inspection, these spots were determined to be round, raised, capillary-filled protrusions. These protrusions occurred in 8:73 (11%), 1:3 (33%) and 2:45 (4%) of the respective populations in 2005 and in 10:45 (22%), 2:12 (16%) and 1:44 (2%) in 2006. Occurrence of these protrusions ranged from 0 - 7 per individual. A permit was obtained in 2006 to collect one individual and perform a microbiological assessment. The adult individual selected had three red spots; two were swabbed for microbiological analysis. Colonies of beta hemolytic positive bacteria were selected and identified using an API 20E bacterial identification strip. All colonies tested were identified as *Aeromonas hydrophila* with a 95% confidence. Additional tests were performed on a blood sample and no colonies of *Aeromonas* spp. were identified. This suggests that the infection is limited to the epithelium. The occurrence of these infections appears to be higher at one study site. This site has an unusually large number of stress inducing factors including: deforestation, high human activity, litter accumulation and mechanical wear. This may represent a case where multiple stressors have created a situation where a common bacterium now poses a threat to this salamander. More studies will be needed to determine if the protrusions continue or increase.

- 199 WEBB, CLIFFORD J. AND GEORGE CLINE. Jacksonville State University—Efficacy of leaf litter refugium bags for sampling adult streamside salamanders (Caudata:Plethodontidae).

Assessment methods exist for monitoring anuran populations but few techniques are available for monitoring caudatans. Salamander populations are abundant, with stable numbers over time and are an important component for nutrient cycling in an ecosystem but are difficult to quantify. This study evaluated a new method of surveying salamanders: leaf litter refugium bags. Hand collection was also employed. The study seeks to ascertain a difference in bag use interspecifically and intraspecifically across habitats. Previously, these bags were used primarily to evaluate larval populations. This 14 month study is part of a larger study that utilizes these bags for sampling adult stream salamanders. The study site is a first order, intermittent stream in the Talladega National Forest (33° 32'57.4"N, 85°49'23.7"W) in Alabama. Three reaches were sampled. Each reach contained three hydro-geomorphic (HGM) units: riffle, glide and pool, with one repeat per reach. Bags were placed in all three HGM units as well as in the thalweg, splash and riparian zone of each unit. Seven different species of salamander were collected: *Eurycea cirrigera*, *Eurycea guttolineata*, *Desmognathus conanti*, *Plethodon glutinosus*, *Plethodon serratus*, *Gyrinophilus porphyriticus* and *Pseudotriton ruber*. Trap efficacy varied among species producing the highest numbers for *D. conanti* and *E. cirrigera*. There appeared to be a positive correlation between bag usage in riffles, thalwegs and splash zones with 45% of salamander bag use in the splash zone. All salamander numbers are reported as catch per unit effort.

- 200 KLUCZNIK, DANIEL J. AND JONATHAN AKIN. Northwestern State University of Louisiana—Symbiosis Between Algae and *Ambystoma* Salamanders in a Louisiana Vernal Pool.

The egg masses of *Ambystoma* salamanders in a Louisiana vernal pool were examined for the presence of a symbiotic alga. Some egg masses of *Ambystoma maculatum* were found to have algae. We isolated egg masses with algae and without algae at similar developmental stages and monitored their development *in situ*. We found that egg masses with algae developed faster and hatched sooner than egg masses without algae. Our results support the notion that the symbiotic relationship between the alga and the salamanders is a form of mutualism.

201 BOND, TRISTAN AND THOMAS K. PAULEY. Marshall University—Distribution and natural history of *Desmognathus welteri*, the Black Mountain Salamander.

The Black Mountain Salamander, *Desmognathus welteri*, is listed as S2 (very rare and imperiled) by the WVDNR. Given the threat of extirpation, this species is in need of studies to facilitate a conservation effort. Streams in southern West Virginia were searched to determine presence or absence of *D. welteri*. A study of habitat partitioning and phenology was performed in two streams in Camp Creek State Park, Mercer County, WV. Variables measured in relation to habitat partitioning included cover object size and distance to water as well as intraspecific and interspecific spacing between individuals. Data recorded for the phenology study included water temperature and number of salamanders observed on each date during one-hour visual encounter surveys. Three new sites were found for *D. welteri*, including the first ever documented occurrence of this species in sympatry with *D. quadramaculatus*. *Desmognathus monticola* selected sites significantly farther ($P = 0.0002$) from the water when sympatric with *Desmognathus welteri* ($\bar{x}_1 = 25.4$ in.) as compared to when it was the dominant species ($\bar{x}_2 = 8.8$ in.). Surface abundance reached zero when the water temperature cooled to 7 °C in the fall. Observation of surface abundance in relation to water temperature will continue throughout the winter and through the period of reemergence in the spring.

202 KEITZER, STEVEN AND THOMAS PAULEY. Marshall University—Potential habitat characteristics affecting the Eastern Hellbender, *Cryptobranchus a. alleganiensis*, in southern West Virginia.

The Eastern Hellbender, *Cryptobranchus a. alleganiensis*, is considered threatened in West Virginia. However, the current distribution is unknown and there have been few studies within the state. The goals of this project were to identify their distribution in southern West Virginia and habitat characteristics that may influence this distribution. Specimens were collected using rock-turning surveys from May through November, 2006. Water temperature, specific conductivity, pH, dissolved oxygen, and turbidity were measured since hellbenders may be sensitive to water chemistry. Wolman pebble counts were used to classify stream substrata because hellbender occurrence could be influenced by particle size. Data were analyzed with t-tests to determine which habitat characters were associated with hellbender presence. Significant variables were used in PCA to examine separation of sites in a two-dimensional space. Hellbenders were observed at 8 of 68 sites, suggesting a narrowing of their distribution. Preliminary results indicate that several factors may be contributing to this trend. Hellbenders were found at sites that had high D₅₀ scores, probably because large rocks are needed for nests and cover. Sedimentation could limit access to large rocks and may be why sites where they were found had lower percentages of sand and gravel. Hellbenders breathe through their skin, so it is surprising that sites where they were collected had a lower % DO. Further analyses are needed to examine why hellbenders were not collected at apparently suitable sites.

203 CANCELED: PAPER NOW POSTER 46B

- 203B** PICCININNI, FRANK¹, SUSANNAH LERMAN², AND THOMAS K. PAULEY¹. ¹Marshall University and ²University of Massachusetts, Amherst—Development, small mammals and ambystomid terrestrial habitat requirements
SUBSTITUTED FOR CANCELED PAPER ABOVE

Human development has created a need for further research regarding terrestrial habitat requirements of ambystomid salamanders. Few published studies regarding the relationship between small mammal burrowing activity and ambystomid salamanders have been conducted. This study was conducted to draw attention to this relationship, as well as analyze the extent that development affects rodent burrow density. Powerlines proximal to breeding populations of ambystomids were used as an example of development. A significant difference in small mammal burrow density between forested and developed plots (t-stat=-4.837, p=.0001, n=17) was shown by a non-parametric analysis. Additional research is necessary to document ambystomid terrestrial habitat requirements. Quantifying terrestrial habitat characteristics could help strengthen existing conservation legislature and facilitate dispersal of ambystomids.

- 204 POOLE, TYLER AND JONATHAN AKIN. Northwestern State University of Louisiana—Investigations into the physiology of behavioral interactions in *Scincella lateralis*.

Signaling theory states that honest signals should indicate truly the condition and/or intention of an actor in a behavioral interaction. In the ground skink, *Scincella lateralis*, some males engage in an endurance contest, called parallel writhing, in which males that perform the behavior longer win the contest. We examined, using respirometry, whether males who won the contest truly expended more energy than males that lost. Our results suggest that males are signaling energy reserve or strength to their opponents and the behavior appears to be an honest signal.

- 205 PEINHARDT, BOBBY AND MEGAN GIBBONS. Birmingham Southern College—Effects of heritability and diet on morphological and behavioral traits in the green treefrog *Hyla cinerea*.

Morphological and behavioral phenotypes are typically determined by a complex interaction of heritability and the environment. We conducted a study on green treefrog larvae (*Hyla cinerea*) to determine the relationship between genetic and environmental effects on traits that may be strongly associated with individual fitness, such as time to metamorphosis, mass at metamorphosis, tail length at metamorphosis, survival, and jumping ability. We collected 5 pairs of adult frogs in amplexus, and haphazardly selected 100 tadpoles from each resulting clutch. Each clutch was divided into 20 groups of 5 tadpoles; 10 groups were fed high protein diets and 10 were fed low protein diets. There were significant effects of diet, clutch, and their interaction for both time to metamorphosis and mass at metamorphosis. For tadpole survival, only diet had a strong effect. There was no effect of either diet or clutch on jumping ability or tail length, but these two traits were highly correlated. In this case, we found that while behavioral traits were more variable, the morphological traits were more strongly influenced by heritable and environmental factors.

- 206 WARE, DANIEL F. AND THOMAS K. PAULEY. Marshall University—The natural history and distribution of the Mountain Earthsnake, *Virginia v. pulchra* in West Virginia.

The Mountain Earthsnake, *Virginia v. pulchra*, has received little attention in West Virginia over the last 20 years and is listed as an S2 species, i.e., there are less than 20 documented populations in the state. We examined its' distribution and natural history

throughout the high elevations in the state from late May to late October 2006. Historical populations were examined to determine their current status. Monthly and daily time of appearance was evaluated based on when each snake was caught. Soil temperature measurements were taken for each capture and compared between sexes. Four new populations were found in Preston and Pocahontas counties. Fifty six percent (30 of 53) of the snakes were caught between the hours of 2:00 pm and 6:00 pm. No significant differences ($P=0.22$) were found in soil temperature selection between males ($\bar{x}=18.6$) and females ($\bar{x}=19.6$). In conclusion, *Virginia v. pulchra* is more active during afternoon hours, possibly to avoid cooler mornings and evenings that are common in the mountains. Both male and female snakes prefer warm soil temperatures to aid in digestion and reducing the gestation period. Future work planned includes soil sample analysis to determine any role water moisture, particle size, and pH might play in habitat selection. With so few populations, *Virginia v. pulchra* is still vulnerable to extirpation and should remain an S2 species in West Virginia.

207 CANCELED

208 CRAVEN, KATHRYN STEPHENSON, MATTHEW RICHARDSON AND LAUREN BROOME. Armstrong Atlantic State University—Evaluation of egg failure in the loggerhead sea turtle (*Caretta caretta*) on the Georgia coast.

The goal of this project was to examine the embryological state of unhatched eggs in the threatened loggerhead sea turtle (*Caretta caretta*). Intact eggs from fully incubated wild nests were collected from Wassaw, Sapelo and Jekyll Islands on the coast of Georgia during the 2004, 2005 and 2006 nesting seasons. Two hypotheses were investigated. First, that egg failure was not a result of infertility; and second that embryonic death occurred most frequently during the first ten days of development. All eggs used for this study were intact and immediately preserved in 10 % formalin or 70 % ethanol. The eggs were dissected, observed macroscopically and the contents were classified according to the amount of development. The straight-line carapace length (SCL) of recovered embryos was recorded. Categories of development included: undetermined, infertile (no metabolism of albumin or yolk), fertile (yolk metabolized, no visible embryo), embryonic disc (mass of tissue, no eye spots), early embryonic death (EED, SCL less than 1.0 cm), mid-embryonic death (MED, SCL 1.01-2.0 cm), and late embryonic death (LED, SCL > 2.01). Overall fertility was defined by the presence of an embryo, embryonic disk, blood streaks or metabolized yolk and albumin. Sampling eggs from different islands attempted to eliminate bias associated with latitude and the impact of human populations. Fertility was greater than 90 %, and most embryonic death occurred during the first ten days of incubation. Future investigations should focus on the developmental sensitivity of the embryos or environmental variables which can compromise nest success.

Animal Ecology III

209 PITTMAN, SHANNON E. AMORY L., JENDREK, STEVEN J. PRICE AND MICHAEL E. DORCAS. Davidson College—Spatial and temporal distribution of Cope's Gray Treefrogs (*Hyla chrysoscelis*) within a wetland.

Ephemeral wetlands are known breeding sites for many amphibian species, although recent studies have suggested that terrestrial habitat surrounding wetlands is also critical to many amphibian populations. Cope's gray treefrogs (*Hyla chrysoscelis*) use both wetlands and terrestrial habitat, but it is difficult to study treefrogs in these habitats due to their cryptic nature and arboreal habitat use. In this study, we used PVC pipe refugia to examine habitat use, movement, and seasonal phenology of *H. chrysoscelis*. We placed a grid of 100 pipes throughout a wetland and surrounding upland habitat. We checked

pipes biweekly for 18 months and uniquely marked or identified all individuals captured. We captured 76 individual *H. chrysoscelis* a total of 177 times. Nineteen spring peepers (*Pseudacris crucifer*) were also captured. *Hyla chrysoscelis* were present in pipes from late March until mid-November, but were not found during winter months. Treefrogs preferred refugia near terrestrial microhabitats with some canopy cover throughout all seasons (64 captures in 26 pipes) compared to the open wetland (1 capture within 20 pipes). Individuals exhibited high site fidelity; of 50 individually-marked frogs, only three moved to different pipes. Understanding the distribution and movement of *H. chrysoscelis* is important to understanding amphibian life cycles and emphasizes the importance of protecting upland habitat surrounding wetlands.

- 210 HARDEN, LEIGH ANNE, STEVEN J. PRICE AND MICHAEL E. DORCAS. Davidson College—Terrestrial activity of Eastern Mud Turtles (*Kinosternon subrubrum*) on golf courses: an investigation of habitat selection.

In urbanized landscapes, golf course ponds may provide the only remaining suitable habitat for semi-aquatic turtles. Eastern mud turtles (*Kinosternon subrubrum*), which rely heavily on not only aquatic, but terrestrial habitats, may face unique challenges on golf courses with heavily modified terrestrial habitat. We conducted a radiotelemetric study of 11 mud turtles inhabiting a local golf course pond in the western Piedmont of North Carolina to investigate their terrestrial activity and habitat selection in a fragmented landscape. In conjunction with radiotelemetry, we used micro-dataloggers to continuously monitor both turtle and environmental temperatures. All but one mud turtle emerged from the pond during the summer or fall (emergence dates ranged from 15 July to 13 October 2006). Turtles moved a mean total distance of 182.2 m ranging from 0 to 787.9 m. On average, mud turtles moved 5 times before selecting an overwintering site. Most turtles selected upland forested habitat for overwintering with overwintering sites primarily consisting of moderate canopy cover ($p < 0.001$), deep leaf litter ($p = 0.06$), and herbaceous vegetation ($p = 0.06$). Mud turtle temperatures were closely correlated with environmental temperatures of the habitat they used (e.g. pond and soil). Data resulting from our studies will assist in developing effective habitat management plans for wildlife on golf courses and other urbanized areas.

- 211 ROGERS, TRACY N. AND DAVID R. CHALCRAFT. East Carolina University—Facilitation or competition? Hydroperiod may alter interspecific interactions among larval anurans.

Many amphibians complete the first part of their bi-phasic life history in ponds that retain water for brief periods of time. Anurans exploit ephemeral ponds for larval development and pressure to metamorphose increases as ponds dry. Studies show that competition can reduce development and growth rates of larval anurans. Larval anurans that metamorphose earlier and larger will have an increased fitness as adults. We examined how pond drying and interspecific interactions between tadpoles of the squirrel treefrog, *Hyla squirella*, and the southern toad, *Bufo terrestris*, influenced growth and development in temporary ponds. We conducted an experiment in artificial ponds by independently manipulating pond hydroperiod (50d; 100d) and abundance of interspecific and intraspecific competitors. As expected, intraspecific competition was observed in both species across both hydroperiod treatments. Moreover, the strength of intraspecific competition was always greater than interspecific competition. More novel are the preliminary results which suggest that *Hyla* metamorphose at larger sizes and at a faster rate in the presence of *Bufo* when ponds dry more quickly. In the long hydroperiod treatments, however, *Bufo* negatively impacts mass and larval period of *Hyla*. Conversely, *Bufo* metamorphose at larger sizes and at a faster rate in the presence of *Hyla* in ponds that dry more slowly. Yet, in ponds that dry quickly, *Hyla* competes with

Bufo. These trends suggest that the rate of pond drying causes the nature of interspecific interactions to shift from competitive interactions to interspecific facilitation.

- 212 WINNE, CHRISTOPHER T., JOHN D. WILLSON AND J. WHITFIELD GIBBONS. University of Georgia—Rapid recovery of an aquatic snake community following prolonged drought.

Coping with climatic variation and associated fluctuations in resource levels is one of the greatest challenges to organisms in many ecosystems. Extreme drought, in particular, is among the most powerful selective forces and has been implicated in the evolution of numerous species, character traits, and life-history attributes. For aquatic organisms inhabiting isolated wetlands specifically, droughts pose one of the most obvious challenges to population stability and persistence. We have monitored the aquatic snake community at a large, isolated freshwater wetland since it began to refill after a 2.5-year drought (August 2000 to February 2003). *Seminatrix pygaea* survived droughts by aestivating within the dried wetland and exhibit similar relative abundance in pre- and post-drought years, whereas sympatric semi-aquatic snakes that do not aestivate (*Nerodia fasciata* and *N. floridana*) experienced precipitous declines during drought. Here, we document patterns of recovery for the wetland snake community over the 3.5 years since the wetland was last dry. In particular, we demonstrate that *N. fasciata* rapidly rebounded, returning to pre-drought abundance within three years. Moreover, *Seminatrix pygaea* increased in abundance and achieved record body sizes and levels of reproduction during the post-drought period. Overwhelmingly, the rapid recovery of the snake community appears to be driven by changes in amphibian prey abundances, which have increased substantially since the refilling of the wetland in 2003. Our results highlight important interspecific differences in population dynamics and have important implications for wetland conservation.

- 213 GIBBS, SARAH AND ERIC LINDER. Mississippi State University—The Impact of greentree reservoir management on the reproductive Ecology of acadian flycatchers at Noxubee National Wildlife Refuge.

Historical loss of bottomland hardwood forests (BHF) in the southeastern United States has created a shortage of habitat for species that depend on this forest type. In response, land managers have established greentree reservoirs (GTR) to increase the amount of flooded BHF habitat available to wintering waterfowl. Even though this is a common management strategy in the southeastern United States, there is a lack of research focusing on the effects that GTR management has on the nest survival of non-game species. We explored the effects that GTR management had on the breeding ecology of Acadian Flycatchers at Noxubee NWR in east-central Mississippi. Nest survival data was modeled using Program MARK according factors known to affect the species' reproductive success. Results from the modeling exercise suggest that the contents of the nest (egg or nestling) and year effects can lead to high variation in nest survival of the population. The main factor of interest, GTR management, was shown to have less influence on variation in nest survival than other factors. Additionally, we analyzed the effects that GTR management and year have on the egg laying, hatching and fledging rates of the nests across years. These results showed significant between year variability in fledging rates across both BHF and GTRs. A high predation rate (75%), substantial annual variability unrelated to habitat type and the fluctuation in nest survival according to the nesting stage suggests that nest predation, rather than GTR management, is having the largest influence on this breeding population.

- 214 VINDIGNI, MELISSA¹, MATINA KALCOUNIS-RUPPELL¹ AND DARREN MILLER². University of North Carolina-Greensboro¹ and Weyerhaeuser Company²—Influence of modified water sources in a managed pine landscape on bat foraging behavior.

Bats forage over large, calm, open water presumably because of high insect abundance, decreased flight obstacles, and low echolocation interference. Southeastern pine plantations are economically important and responsible for 60% of the United States timber production. Heliponds and manmade drainage ditches are a primary landscape feature of plantations in coastal North Carolina. Our objective was to determine how different water sources in a managed pine landscape affected bat foraging behavior. The 2006 field season occurred on an intensively managed loblolly pine forest and on an adjacent natural forested wetland in eastern North Carolina. We used mist netting, remote acoustic sampling, and passive insect trapping to collect data on bat community structure, foraging activity, diet, and insect community structure. Passive insect traps and full spectrum Pettersson D240x detectors were used to sample different water sources throughout the night. Echolocation calls were analyzed for bat species presence and foraging activity. Insect samples were identified to Order. Sampling occurred 10 times at 5 heliponds, 9 interior ditches, 14 edge ditches, and 2 natural forested wetland sites ($n = 61$ sample sites over 34 nights). Preliminary results suggest that heliponds and edge ditches have higher bat abundance relative to other water sources. *Eptesicus fuscus* and *Lasiurus borealis* were present at all sites while *Myotis* spp. and *Tadarida brasiliensis* were predominantly found over interior ditches. Insect abundance was greater in natural forested wetlands. Within the managed forest, heliponds and edge ditches appeared to have greater insect abundance compared to interior ditches.

- 215 SAUTERER, ROGER. Jacksonville State University—Exposure of frog embryos to water samples near the Anniston, AL Monsanto plant results in increased mortality and decreased growth.

The Monsanto plant in Anniston, AL is of great environmental concern due to the PCB contamination that has made it a major EPA Superfund site. Despite cleanup efforts, contamination of local waters and soils still persist. Previous investigations of waters from Snow and Choccolocco Creeks near the Monsanto plant using the 4-day FETAX developmental toxicity assay show subtle but significant growth inhibition in *Xenopus* embryos. *Xenopus* embryos were raised in water samples from Snow Creek from the late blastula stage to 21-24 days in order to expose the embryos during developmental stages where their sensitivity to PCBs is greater. Preliminary data shows both increased mortality and decreased growth in the embryos reared in Snow Creek as compared to the controls. Although experimental embryos behaved normally for the first two weeks, they became noticeably lethargic and inactive during the third week as compared to the controls. Diluted Snow Creek water shows a much lesser effect. The data suggests that either Snow Creek waters still contains substances toxic to *Xenopus* embryos or that it is missing ions or other substances crucial for development.

- 216 WOLFF, ROBERT. South University and Clemson University—First BioBlitz at Congaree National Park is a SpiderBlitz.

Congaree National Park is the newest National Park in the U.S. It contains the largest tract of old-growth floodplain forest in North America. The park is designated as a Wilderness Area, a National Natural Landmark and an International Biosphere Reserve. A BioBlitz was planned, focusing on spiders and conducted with volunteer help. Even though the Press Release only engendered a small notice in the regional newspaper, over 50 volunteers participated (the largest group 'helping' on any project at CNP before this was 12). From very young children to senior citizens the volunteers collected spiders by

hand and with sweep nets. So far over 100 species have been identified, and many species not previously recorded were collected. The enthusiasm, safety, results, and lack of apparent negative impact on the forest all lead to an overall evaluation of great success. Most participants asked when the SpiderBlitz would be conducted again, so future plans are in progress.

Aquatic, Wetland and Marine Management II

- 217 ATKINSON, ROBERT B. Christopher Newport University—Atlantic white cedar tree rings in the Great Dismal Swamp and Alligator River National Wildlife Refuges: Implications for saving an endangered ecosystem.

Atlantic white cedar (*Chamaecyparis thyoides*) (cedar) swamps is a globally-threatened wetland ecosystem that once was a major component of the Great Dismal Swamp National Wildlife Refuge (GDS) and Alligator River National Wildlife Refuge (AR). Reestablishing this wetland type requires appropriate hydrologic conditions, but limited hydrologic data is available to determine cedar requirements. The purpose of this study was to determine the effect of climate on growth rate for four cedar stands within two age-classes in GDS and AR to determine hydrologic requirements of the species. Transects with a total of nine plots, each with two subplots, were established in each stand. In each subplot, three trees were selected, cored, aged, and ring widths were determined using Measure J2X software. Mean ring widths among GDS sites was roughly 2x greater than at AR, however, tree stem density was somewhat greater at AR. Regression models detected significant relationships for both temperature and precipitation in GDS ($r = 0.446$) and in AR ($r = 0.647$). Though climate effects on this species are complex, patterns of ring width among sites appear to result from water table differences, which suggest that water levels at AR may favor cedar restoration.

- 218 GEORGE, ROBERT Y.¹ AND ANDY WOOD². George Institute for Biodiversity and Sustainability¹ and North Carolina Audubon Society—Threats to the deep water *Lophelia* reefs and migratory birds (swans and geese) in North Carolina coast: Potential EFH and EBH sites.

The U. S. Navy has proposed two areas for military-related activities in the North Carolina coast. A sonar-testing site of 600 square miles was chosen in the Onslow Bay where *Ben Franklin* cold coral reefs and *Lophelia* deep-sea reefs (300 – 450 m) occur (George, 2002). Another site is the Outlying Landing Field (OLF) of 900 square miles where migratory Tundra swans (*Cygnus columbianus*) winter-over. Conservationists have recommended to abort the plans. Magnuson-Stevens Act successfully implemented protection of endangered fish species with Essential Fish Habitats (EFH) and Habitat Areas of Particular Concern (HAPC). EFH contains suitable habitats and food sources essential for long-term survival of the resident and migratory species. The snowy grouper (*Epinephelus niveatus*) in Onslow Bay reefs and deep-sea wreckfish (*Polyprion americanus*) need protection. We are presenting data on declining populations of migratory Canadian Goose (*Branta canadensis*) and Snow Goose (*Chen caerulescens*). The Red Wolf (*Canis rufus*), an endangered species, inhabits the OLF site and is threatened by habitat fragmentation and hybridization with Coyotes (*Canis latrans*). We are providing science-based arguments to justify the status of "Essential Bird Habitat" (EBH) for the OLF site in the northeastern North Carolina's coastal plain. Our goal is to induce US Navy to reevaluate their original plans to implement both the mid-frequency SONAR site and the OLF site. We believe that the Navy will take a prudent decision to abandon plans to obliterate the wildlife in these two sites.

- 219 DORCAS, MICHAEL E.¹, JOHN D. WILLSON² AND J. WHITFIELD GIBBONS². Davidson College¹ and Savannah River Ecology Laboratory²—Crab trapping causes population decline and demographic changes in Diamondback Terrapins over two decades.

Diamondback terrapins (*Malaclemys terrapin*) are thought to be declining throughout their range. Many factors have been proposed as contributing to terrapin declines, including human-subsidized predation of nests and adults, habitat loss and degradation, road mortality, commercial harvest, and mortality as bycatch in crab traps, yet few studies have provided evidence directly linking these agents to population declines. Because male and small female terrapins are most susceptible to mortality in crab traps, population declines due to crab trap mortality should coincide with shifts in the age and size distributions of the population and a shift to a more female-biased sex ratio. We used 21 years of mark-recapture data (>2800 captures; 1399 individuals) from a declining terrapin population in South Carolina to test the prediction that the decline is the result of mortality in crab traps. Since the 1980's, the modal size of both male and female terrapins has increased substantially and the proportion that are females is higher. Additionally, the population now contains more old and fewer young individuals than before. These changes in demography and sex ratio suggest that this population has declined as a result of selective mortality of smaller individuals in crab traps. The use of bycatch-reduction devices on crab traps may help prevent terrapins from entering the traps, but current models are too large to prevent mortality of males and many females in this population. Future research should focus on design and testing of effective bycatch-reduction devices and other methods to reduce terrapin mortality in crab traps.

- 220 THIGPEN, ROBERT C., III. Appalachian State University—Water flux in the caribbean spiny lobster (*Panulirus argus*) product, a socioeconomic concern, a fisheries sustainability issue.

Every year the fishing cooperatives of Belize lose hundreds of thousands of dollars due to water loss of their products. The majority of these losses are in Caribbean Spiny Lobster (*Panulirus argus*) products. There are processing practices and out of date regulations that contribute to this. In this paper, I will look at these practices in order to determine if some of this water loss can be prevented and whether any of these practices may be harming the fishery. The Belize Fisheries Act of 1948 states that for legal sale lobster, the tail must weigh at least 112 grams, however, my research indicates that lobsters with a beginning tail weight as little as 83 grams can be sold at a legal weight following common processing practices. Current research indicates that these lobsters have never had a reproductive opportunity. This is due to water weight gain due to necessary pre-processing techniques employed prior to sale to the co-operatives. After sale to the co-operatives, that serve to market lobster meat to large international vendors, lobster tails lose this water weight gain in a matter of hours, resulting in losses to market readyproduct weight since purchase from lobstermen. Additional to the direct monetary loss to the co-ops, there is also the loss of reproductive stock, because the water weight gain allows pre-reproductive age lobsters to be sold at a legal weight. A comprehensive study must be undertaken in order to bring current fishery regulations up to date if the fishery is to be sustainable.

- 221 MEADE, MARK, BENJIE BLAIR AND JONATHAN SPURGIN. Jacksonville State University—Use of anaerobic probionts as supplemental feeds in fish culture.

In recent years probiotics have become an increasingly integral part of aquaculture. In our labs, we are examining the use of anaerobic probiotics as supplements in feed formulations for the culture of larval fishes. In this study, we report on the effects of an anaerobic bacterium supplemented in feeds proffered to tilapia and catfish fry. All fish

were fed a commercial fish ration that contained a minimum of 28% crude protein (Aquamax® Dense 4000, PMI Nutrition International, Inc.). In a single experimental trial feed was proffered to two groups of fish and was supplemented with anaerobic bacteria (*Eubacterium cellulosolvens* 5494). Simultaneously, other tanks of fish were fed only the fish ration. Control groups of fish were also supplemented heat killed bacterial cells along with the fish ration. Following the initial feeding all fish were fed solely the fish ration not containing bacteria. In one study, a second administration of bacteria was proffered with feed after one week. Fish weights and survival were monitored after 30-60 days of culture. In all trials, final mean wet weights were significantly greater in fish treated with the bacteria compared to control, non-treated fish. In some cases, compensatory growth was observed in smaller fish when fed the probiotic supplement. Fish supplemented heat killed bacteria also demonstrated improved growth. Currently we are using molecular techniques to investigate the role of gut microflora in fish digestive processes and the effects of introduced probionts to native gut flora.

Invertebrate Zoology and Entomology II

222 THIGPEN, ROBERT C., III AND ROBERT P. CREED. Appalachian State University—Stable isotope analysis shows ontogenetic diet shift of the Caribbean Spiny Lobster (*Panulirus argus*).

The spiny lobster fishery is the most culturally and economically important fishery in the Caribbean basin. Knowledge of the diet of spiny lobsters during their life history is important if we are to effectively manage this resource. Early life stages of spiny lobsters are planktonic. After 6-12 months, these planktonic larvae recruit to shallow nearshore habitats, particularly algal mats, as puerulus larvae. After 7-10 days puerulus larvae metamorphose into algal stage juveniles. After the algal stage, young spiny lobsters become juveniles. While both young and adult spiny lobsters are known to feed on invertebrates it is not clear if an ontogenetic diet shift occurs between the early and later life stages. The carbon signature ($\delta^{13}\text{C}$) of the puerulus larvae was much less enriched than that of the later stages. The carbon signatures of algal stage lobsters, juveniles and adults were fairly similar. Algal stage lobsters and adults occupied different trophic levels based on nitrogen isotopic signatures ($\delta^{15}\text{N}$). As the juveniles increased in body size they became more enriched in nitrogen with large juveniles having a nitrogen signature similar to that of adults. Our data suggest a rapid shift in carbon isotopic signature from the puerulus to the algal stage. In addition, our data show that a gradual transition in trophic level placement occurs during the juvenile stage, a period which may last 2-3 years.

223 CANCELED

224 BORING, C. SHANE¹, JOHN M. ALDERMAN², JENNIFER M. SUMMERLIN¹ AND JOSEPH D. ALDERMAN². Kleinschmidt Associates¹ and Alderman Environmental Services, Inc.²—Freshwater mussel assemblages of the lower Saluda and Congaree rivers, Lake Murray, and selected tributaries in the central Santee River Basin, South Carolina.

More than 300 recognized species and subspecies of freshwater mussels are known from North America north of Mexico. Nearly 72% of these taxa are considered endangered, threatened, or of special concern to the scientific community. Of these, twenty-one species are listed as occurring or having historically occurred within the Santee-Cooper River Basin in South Carolina. During June through August 2006, timed surveys for freshwater mussels were performed at sixty-one sites in Lake Murray and selected tributaries, as well as the lower Saluda River, upper Congaree River, and the mouth of the Broad River downstream of Lake Murray Dam. Surveys documented fifteen freshwater mussel species as extant within the study area: *Elliptio complanata*, *E. icterina*, *E.*

angustata, *E. fisheriana*, *E. producta*, *E. roanokensis*, *E. congaraea*, *Unio merus carolinianus*, *Utterbackia imbecillis*, *Pyganodon cataracta*, *Strophitus undulatus*, *Villosa delumbis*, *Lampsilis cariosa*, *L. splendida*, and *Toxolasma pullus*, six of which are considered federal species of concern by the U.S. Fish and Wildlife Service. Mussel assemblages for Lake Murray sites were dominated by backwater-adapted species, namely *Utterbackia imbecillis*, *Pyganodon cataracta*, and *Unio merus carolinianus*, while abundance at study sites downstream of the Lake Murray Dam were dominated by species best adapted to lotic habitats, such as *Lampsilis cariosa* and various *Elliptio* species. While not highly quantitative in nature, this study documents the spatial occurrence of several mussel species in a portion of their historic ranges that has not been surveyed in recent history.

- 225 DIMOCK, RONALD V., JR. Wake Forest University—An insider's guide to clam gills.

The archetypical molluscan gill filament has 3 principal surfaces: frontal, abfrontal and lateral, each of which is ciliated and performs a specific function. The ctenidium of eulamellibranch bivalve molluscs has diverged markedly from the primitive design, notably by great elongation of individual filaments, their narrowing in the frontal-abfrontal axis, and flexion, resulting in V-shaped filaments comprising a demibranch on each side of the axis of support. The primitively dorsal abfrontal surface now constitutes the interior of each demibranch. With video endoscopy it is possible to image this interior compartment *in vivo*, visualizing interlamellar septa, water tubes, and internal ostia. Freshwater mussels of the Order Unionoida sequester developing embryos within the water tubes to the shelled glochidium larval stage, at which they are released by parental mussels to assume an obligate, transient parasitism with host fish. Scanning Electron Microscopy (SEM) reveals details of abfrontal ciliation, internal ostia, gill architecture, and the position of brooded glochidia larvae. Although the gills of the families Unionidae and Hyriidae are eulamellibranch, the internal structure of the respective demibranchs is markedly different. Any notion that the abfrontal aspect of mussel gills is a simple, hollow space is incorrect.

Microbiology II

- 226 THOMASON, KATHERINE AND MIN-KEN LIAO. Furman University—Isolation and characterization of tetracycline-resistant *Escherichia coli* in Furman Lake.

High concentrations of *Escherichia coli* in water represent a high risk to public health; moreover, the presence of antibiotic-resistant bacteria in the environment presents an even greater risk. Hence, in this study, we focused on the isolation and characterization of tetracycline-resistant *E. coli* in Furman Lake. We investigated these tetracycline-resistant *E. coli* isolates by (1) comparing the genetic diversity of the tetracycline-resistant *E. coli* population to that of the tetracycline-sensitive population, (2) constructing antibiotic-resistant profiles, (3) determining the transferability of the tetracycline-resistant gene(s), and (4) detecting the presence of class I integron. We isolated and genetically typed 131 tetracycline-sensitive strains and 59 tetracycline-resistant strains. To compare the diversity of *E. coli* isolates, we determined the ECOR type (A, B1, B2 or D) of each isolate. *E. coli* have been shown to fall into four main phylogenetic groups: A, B1, B2, and D where most pathological strains are type B2 and most commensurable strains are type A. A chi-square analysis revealed that the genetic diversity of these two groups were significantly different ($p < 0.001$) suggesting that fewer likely pathological strains and more likely commensurable strains tended to exhibit tetracycline resistance. The Kirby-Bauer method was employed to determine the antibiotic-resistant profiles of each resistant isolate, and resistance indices for each antibiotic were determined. Furthermore, 27% of these isolates proved capable of transferring the tetracycline-resistant trait via conjugation.

The process of acquiring and transferring antibiotic resistance traits is in need of further study. The presence of integrons is currently under investigation.

- 227 EVERHART, SYDNEY E., HAROLD W. KELLER AND JOSEPH S. ELY. University of Central Missouri—Ecology of canopy myxomycetes (true slime molds) on trees and grapevines (*Vitis aestivalis* and *V. vulpina*).

Corticolous myxomycetes (true slime molds) are fungus-like organisms classified as Protista that form plasmodia, fruiting bodies, and resting stages (spores and sclerotia) on the bark of living trees and vines. Previous studies indicate that there is high species diversity and abundance of corticolous myxomycetes on grapevines but no comprehensive study exists. The objective is to examine grapevines and trees for new records, myxomycete species new to science, and investigate distribution patterns in the tree canopy. The double-rope climbing technique is used to access the canopy and sample every 3 meters along a vertical transect at least 15 meters. In 2006, bark was collected in Kentucky, Tennessee, and Missouri from 60 trees and 60 vines, including a champion sized grapevine (*Vitis vulpina*, 20 centimeters diameter at breast height). To date, bark from 7 trees and 7 vines were cultured using moist chambers (2 cultures per height, per tree and vine). Preliminary results show mean pH for *Fraxinus americana* (6.1), *Tsuga canadensis* (4.2), *Vitis aestivalis* (4.5) and *V. vulpina* (5.8). Accordingly, *Cribraria violacea*, a corticolous myxomycete associated with bark pH 6.0-7.0, occurs in high numbers on *F. americana* and *V. vulpina*. Rare species found include *Clastoderma pachypus*, *Echinostelium coelocephalum*, *Lamproderma biasperosporum*, *Macbrideola cornea*, and *Minikatella longifila*. The bark of 25 trees and 25 vines will be cultured (500 cultures); data will quantify the association of relative species composition, abundance, and diversity of myxomycete species assemblages with environmental characteristics and complete the first comprehensive study of corticolous myxomycetes on grapevines.

- 228 KELLER, HAROLD W., SYDNEY E. EVERHART, COURTNEY M. KILGORE, ANGELA R. SCARBOROUGH AND GLENDA J. CARMACK. University of Central Missouri—Myxomycetes, the true slime molds of Kentucky: new species and records, with field and laboratory observations of plasmodial tracks on a canine skull.

Recent molecular evidence places the myxomycetes on the tree of life in the Kingdom Protista. There are only two published lists of myxomycetes for the state of Kentucky that record a total of 28 species; no list includes myxomycetes from the tree canopy. The purpose of this project is a comprehensive survey of myxomycetes of Kentucky on logs, leaves, and canopy bark of living trees and vines. Most myxomycete field collections (171) of fruiting bodies were gathered from the Berea College Forest and Daniel Boone National Forest in eastern Kentucky during June and July of 2006. Rare species and new state records included: a new species of *Arcyria*, *Didymium serpula*, *Macbrideola scintillans*, and *Physarum galbeum*. The myxomycete life cycle will be described in detail. The zygote undergoes synchronous nuclear divisions without cell division, creating a large, slime stage called a plasmodium. Plasmodia have a fan-like, anterior, feeding edge and posterior trailing veins that occur on decaying leaves and create evidence of their movements as plasmodial tracks. Discovery of plasmodial tracks on a dog skull in leaf litter represents the first report of myxomycetes on skeletal remains of animals. Only the skull and upper jaw were present, with distinct plasmodial tracks covering different areas of the upper palate and molars. Special photographic techniques were used to stabilize the skull for recording digital images and laboratory results of moist chamber cultures of the skull will be described. Financially supported by National Science Foundation Award DEB-0343447 and National Geographic Research and Exploration Award-7272-02.

- 229 MIDDLETON, GERRY. University of Tennessee—Diatom community response to industrial pollution in Bear Creek and East Fork Poplar Creek watersheds, Oak Ridge, Tennessee.

Literature concerning algal response to pollution is extensive, but little is known about diatom community response and microalgal floristics in impacted Tennessee streams. Periphytic algae (diatoms) form the basal food web in benthic freshwaters. Diatoms are sensitive indicators of toxicity and exhibit individual tolerances to contamination. Diatoms respond to toxicity by exhibiting taxa shifts and cell abnormalities. From June 2005 to July 2006, artificial substrates were deployed to allow periphyton colonization in two industrially impacted Tennessee watersheds located near the U. S. Department of Energy Y-12 National Security Complex. The study site is characterized by valley and ridge geomorphology, woodlands, and bounded on three sides by the Clinch River. East Fork Poplar Creek and Bear Creek study sites were chosen to test the hypothesis that diatom diversity would increase with distance from upstream Y-12 contamination sources (heavy metals, organic chemicals, and radionuclides). Hypothesized changes in diatom genera richness and abundance were compared between impacted (n= 7) and reference sites (n= 3). Collected diatom samples were transported to the laboratory, prepared per standard protocols, identified to genera level, and enumerated. Raw data were further evaluated using various metrics plus biovolume calculations. Site-specific water quality, light intensity and current were measured. Preliminary results indicate pollution tolerant diatom taxa (e.g., *Achnanthes minutissima*) dominate populations in at least one upstream site. Genera richness and abundance seemed to improve with distance downstream from the pollution source and at reference sites. Abnormal *Synedra* sp. observed in samples collected from several upstream sites suggests metals contamination.

- 230 YORK, EMILY A., MELISSA B. COLLINS AND SEÁN P. O'CONNELL. Western Carolina University—Bacterial diversity of soils and Hemlock rhizospheres in Great Smoky Mountains National Park.

Assessing bacterial diversity based on cultivation methods is biased toward readily cultured bacterial species; however, molecular cloning methods generally depict that the most abundant bacteria in soils are rarely cultured. Using both techniques should yield a greater representation of diversity, and modification of culturing methods should select for environmentally relevant bacteria. Cultivation strategies for bulk soil and soil removed from hemlock root tips collected from Albright Grove (old growth forest) in Great Smoky Mountains National Park included a variety of low nutrient and long incubation strategies. Molecular cloning from bulk soil was also completed. Forty-one isolates and ninety-one clones were obtained, their 16S rDNA amplified using primers 341F/907R, and identified using the Ribosomal Database Project II. Isolates were from six major groups including three proteobacterial subphyla, two gram positive phyla, and *Bacteroidetes*. Bulk soil isolates showed the least diversity; with *Firmicutes* (74%) being the major phylum. The hemlock rhizosphere isolates included representatives from all six taxa and were dominated by *Actinobacteria* (44%). DNA sequence similarities at the genus level were highest for species isolated with shorter incubation times (90%) and lowest for isolates obtained with longer incubation times (70%). Molecular cloning results showed that the phylum *Acidobacteria*, absent from cultures, dominated Albright Grove (80%). It is best to use multiple techniques to assess diversity; each method showed different microbial communities from bulk soil versus hemlock rhizosphere. Isolating new species – even from commonly cultured phyla – and interpreting their distributions will lead to better understanding of ecosystem functioning.

ASB POSTER SESSION ABSTRACTS**THURSDAY, APRIL 19, 2007****Teaching Biology**

- P1 NIEDZIELA, LINDA. Elon University—Assessment of case studies for content delivery in upper level biology elective courses.

Case studies were used and assessed in two upper-level biology elective courses at Elon University. BIO345 is an upper level major elective course in Genetics and BIO371 is an elective Toxicology seminar course. Both courses offered opportunities to develop and use case studies to provide both content and context that built on foundational knowledge from prerequisites. While each courses taught concepts they focused on critical thinking, problem-solving and application of knowledge. This approach seemed to fit well with the strengths of case studies. So in 2005/2006, the courses were designed (or modified) to focus on a series of case studies that supplemented other pedagogical techniques. Some genetics topics included transgenic animals, The Genetic Information Nondiscrimination Act, human gender determination, and animal breeding. Toxicology used cases on Rachel Carson's influence on public policy, coal mining health and environmental effects, lead poisoning, chemical profiling, drug recalls, and food irradiation. Group assignments were varied and chosen to enhance each case. They included role-play, written and oral position statements, letters to legislative representatives, mechanism determinations, pedigree analysis, breeding schemes, and creative writing. Student evaluations of the instructor and courses were not significantly affected by the use of cases but the majority of students responded positively about each case and the overall experience. Individual cases were analyzed and general conclusions can be made about what was most and least effective. Concerns include grade distribution, group dynamics, and the challenge of appropriate assignment development.

- P2 PRINCE, JOSHUA, LAURA BROOKSHIRE, PRESTON MOORE AND CHRISTINA EDDY. North Greenville University—Development of inexpensive methods for analysis of DNA by agarose gel electrophoresis.

Agarose gel electrophoresis is a routine procedure for determining the size of DNA fragments generated by restriction digests or PCR. This procedure is used to analyze DNA in several laboratory courses including Genetics, Molecular Biology, Biotechnology or Microbiology. We have compared the electrophoresis of DNA samples in gels prepared from reagent grade agarose and inexpensive agar agar purchased from a local Asian market. Electrophoresis in 1% agarose gels showed DNA fragments could be separated efficiently in the agar agar gels although the migration rate was slower in the agar agar than in the reagent grade agarose. DNA was stained with SYBER safe reagent purchased from Invitrogen. Gels were illuminated with high intensity long wave UV light which allows visualization of fluorescent bands of DNA. There was no difference in the quantity of DNA detectable in the different gel types. A method was developed which allowed the fluorescent DNA bands to be photographed with a Kodak digital camera without the use of any special filters. The cost of incorporating electrophoresis in educational labs can be significantly decreased by using agar agar to prepare the gels and digital camera for photographing the results. Reagent grade agarose costs \$1.00-\$2.00 per gram while agar agar \$0.05 per gram. Recording data on a digital camera as opposed to using Polaroid film makes it easier for each student to receive a copy of the data generated by electrophoresis for incorporation into notebooks or reports.

- P3 KIRLIN, MICHELLE S., MARJORIE C. WESTFALL, LEIGH A. HARDEN, KRISTEN K. CECALA, STEVEN J. PRICE AND MICHAEL E. DORCAS. Davidson College—The Davidson College Herpetology Laboratory's outreach program: using amphibians and reptiles as model species for environmental education.

Reptiles and amphibians (herpetofauna) are excellent species for use in outreach activities and environmental education programs. Herpetofauna serve important and diverse roles in ecosystems and thus learning about them increases environmental awareness. Additionally, because many can be easily kept in captivity and handled, herpetofauna offer "up-close" interactive opportunities for the public. The Davidson College Herpetology Laboratory uses herpetofauna as the focus of our outreach programs to raise awareness about the importance of herpetofauna and engage the community in projects focusing on their conservation. Our outreach program includes several ongoing projects, including the Catawba River Corridor Coverboard Program and the Box Turtle Conservation Program. Additionally, Herp Lab members frequently give presentations at local schools and for other organizations. During 2005 and 2006 the Davidson College Herpetology Laboratory gave over 40 presentations to over 2500 people. Additionally, during the spring of 2006, the Herp Lab conducted an after-school "Science Club" at the Ada Jenkins Center focusing on herpetofauna and their importance in their environment. This project used surveys to test children's attitudes, knowledge, and stereotypes about herpetofauna before and after the program. Herp Lab members have also designed curricula for teaching about herpetofauna and their conservation, suitable for grades K-12. These curricula have been tested at local schools and are available online at the Davidson College Herpetology Laboratory's Outreach website (<http://www.bio.davidson.edu/dorcas>) for educators in North Carolina and elsewhere to use.

- P3B MICKLE, JAMES E.¹, MARIA ROSARIA BARONE LUMAGA², PAOLO DE LUCA² AND FULVIA IOVINE². North Carolina State University¹ and Università degli Studi di Napoli "Federico II"²—Development of a new display on the evolution of the carpel and the stamen at the Museum of Paleobotany and Ethnobotany, Botanical Gardens, University of Naples, Italy.

The Museum of Paleobotany and Ethnobotany at the Botanical Gardens of the Università degli Studi di Napoli "Federico II," Naples, Italy, functions primarily as a teaching institution. Located in the "Castle" on the grounds of the botanical gardens, the paleobotany section of the museum occupies two rooms with displays that depict the fossil record from evolutionary and systematic viewpoints, with the centerpiece being a large, three-dimensional phylogenetic tree of the plant kingdom. The new display shows the evolution of the carpel and the stamen. Terra cotta models of the conduplicate carpel hypothesis and the foliar reduction hypothesis of the stamen illustrate evolutionary stages for of these organs. These displays are integrated with displays on fossil angiosperms, floral-animal interactions and current ideas of angiosperm systematics to depict concepts of floral origin and evolution. The display gives visitors a more comprehensive view of plant organ evolution and plant systematics, and thus enhances the teaching mission of the museum.

- P3C TIMMERMAN, BRIANA, DENISE STRICKLAND AND SUSAN CARSTENSEN. University of South Carolina-Columbia—Facilitating the understanding of evolution in an introductory undergraduate laboratory experience: Exploring the impact of an inquiry-based module.

The recent National Research Council (NRC) reform effort focusing on undergraduate biology education *Bio 2010* emphasizes the importance of how students are taught, as well as the content addressed in courses. This paper reports on the assessment of the

effectiveness of inquiry-based laboratory modules for student content achievement and conceptual change with particular focus on the evolution module. Resulting data revealed that the evolution module did support substantial gains in student learning as measured by a pre/posttest (effect sizes .6 – 1.4). An analysis of student open ended responses designed to measure the level of conceptual change indicate that the inquiry modules stimulated a significant ($\alpha = 0.001$) level of metacognition compared to the units using traditional pedagogy. While the study cannot conclusively connect the student gains to specific design principles, our findings support previous research indicating that use of inquiry-based pedagogy emphasizing student collaboration is a promising and effective strategy for the teaching and learning of evolution in an introductory college biology context.

Animal Behavior

- P4 HILL, CHRISTOPHER¹ E., SCOTT TOMKO¹, CHRISTOPHER ELPHICK² AND CARINA GJERDRUM². Coastal Carolina University¹ and University of Connecticut²—Polyandry in the saltmarsh sparrow, *Ammodramus caudacutus*.

Observations of breeding behavior indicate that almost uniquely among songbirds, saltmarsh sparrows have a breeding system that can be characterized from the male perspective as scramble-competition polygyny. Males sing little and inconspicuously, do not defend territories, wander widely during the breeding season, and reportedly attempt to force copulations with females. Females build nests and raise chicks with no assistance from males. Exactly which males females choose or are persuaded to mate with is unknown. To measure genetic paternity, we obtained blood samples from nesting females, their nestlings, and males who were caught within the marshes where females nested. We developed a suite of highly polymorphic microsatellite DNA loci and used microsatellite genotyping to infer paternity. We obtained evidence that in some nests, every chick was fathered by a different male, while in other nests, multiple chicks were fathered by the same male. Incomplete sampling precluded assigning every chick to its father, but we will discuss what can be inferred from population patterns of polyandry and from those specific cases where paternity was assigned to a particular male.

- P5 RICHARDSON, TERRY D.¹ AND ROBERT C. THIGPEN, III². University of North Alabama¹ and Appalachian State University²—Prey size selection in juvenile Caribbean spiny lobster, *Panulirus argus*.

The Caribbean spiny lobster, *Panulirus argus*, is a valuable commercial fishery throughout the entire Caribbean basin. It is an extremely valuable economic commodity as well as being an important cultural resource. However, little is known about spiny lobster predaceous feeding behavior. Understanding foraging behavior in spiny lobster is complicated by a complex life cycle with numerous juvenile stages forming three distinct ecological and behavioral groups exploiting different microhabitats. To examine prey size selection in postlarval and subadult phases of Caribbean spiny lobster, dwarf cerithid snails (*Cerithium lutosum*) were collected and divided into small (<9.5 mm shell length), medium (9.5-13.0 mm SL) and large (>13.0 mm SL) size classes. Each size class was offered ceriths, in excess, to individual juvenile lobsters. Postlarval phase lobsters ate significantly more small snails consuming an average of 36.1 (\pm 8.77 SE) small, 19.6 (\pm 4.56) medium, and 2.4 (\pm 0.98) large snails per lobster. Larger, subadult lobsters showed no statistical preference for any snail size, but did tend to eat more large than medium or small snails, eating an average of 31.3 (\pm 12.03), 16.7 (\pm 7.86), and 18.3 (\pm 6.36 SE) large, medium, and small snails, respectively. Combined, all lobster ate an average of 31.6 (\pm 6.35 SE) small, 18.8 (\pm 3.46) medium, and 10.3 (\pm 4.60) large snails. Previous studies showing a preference overall for small snails failed to segregate snail sizes and

lobster sizes sufficiently to discriminate preference. Size selectivity, however, does occur in smaller, postalgal phase lobster.

- P6 PORTER, TERESA A. AND JENNIFER CRUSE-SANDERS. Salem College—Behavioral comparison of bat and moth pollinators of a cactus.

Many cactus (Cactaceae) species are ecologically and agriculturally important in arid regions of North America. Comparisons of pollination ecology within cactus species illustrate varying foraging strategies of their pollinators that can affect patterns of gene flow in these plants. Bats of the chiropteran family Phyllostomidae, particularly *Leptonycteris curasoae*, *L. nivalis*, and *Choeronycteris mexicana*, are described as the only effective pollinators of the economically important columnar cactus *Stenocereus stellatus* in Central Mexico. Visits by hawk moths (Lepidoptera: Sphingidae) are often disregarded as providing insufficient contact with *S. stellatus* anthers and stigmas to achieve successful pollination. Evidence based on videos of nocturnal pollination visits to *S. stellatus* flowers suggest that hawk moths make sufficient contact with flower reproductive structures to be effective pollinators. Although bat visits were more frequent than visits by hawk moths, moths spent significantly more time per visit to the flowers, sometimes climbing entirely inside the corollas. Surface areas for pollen adhesion on bats and moths were compared, as well as comparison of behaviors expected for effective pollination between the two pollinator types. Different pollinator behaviors have implications for the evolutionary biology of *S. stellatus* and for bats and moths that compete for nectar and pollen resources.

Animal Ecology

- P7 MATHENIA, JOSH M. AND H. DAWN WILKINS. University of Tennessee at Martin—Interactions between resident and migratory woodpeckers in a bottomland hardwood forest in northwest Tennessee.

The competitive exclusion theory states that no two organisms can have exactly the same niche. Woodpeckers belong to the bark foraging guild and are known to partition resources, possibly to reduce competition. The goal of this study was to determine how niche breadth and niche overlap change with the arrival of migratory woodpeckers during the winter. Observations of woodpecker location and behavior were taken every thirty seconds for fifteen minutes. We constructed time budgets and calculated niche breadth and overlap for two migratory and two resident species. Resident species observed were Red-bellied Woodpeckers (*Melanerpes carolinus*) and Downy Woodpeckers (*Picoides pubescens*). Migratory species observed were Red-headed Woodpeckers (*M. erythrocephalus*) and Yellow-bellied Sapsuckers (*Sphyrapicus varius*). Yellow-bellied Sapsuckers were sap-foraging specialists using living trees as a primary food source. This behavior reduced overlap between sapsuckers and other woodpeckers for resources. Downy Woodpeckers were the most generalized. Their small size may help reduce overlap with other woodpeckers. Niche overlap was highest between Red-bellied woodpeckers and Red-headed Woodpeckers. Aggressive encounters were observed between these two species suggesting that competitive interactions may be occurring. While preliminary observations showed overlap between Red-bellied and Red-headed woodpeckers, future studies will attempt to determine if this overlap is due to competitive interactions or is the result of similar foraging strategies.

- P8 MCDONALD, DAX AND ROBERT CARTER. Jacksonville State University—The effects of prescribed burning on small mammal communities in the Talladega National Forest, AL.

The response of small mammal populations in three habitats to prescribed fire was examined on the Talladega National Forest. Mammal populations were surveyed 2.5 months preburn and 9 months postburn. There were small changes in species assemblage in pine dominated sites but no change in hardwood dominated sites after prescribed burning.

- P9 BEATTIE, MICHELLE AND WILLIAM ENSIGN. Kennesaw State University—Ecoregion differences in lipid content of *Campostoma oligolepis*.

The ecoregion concept provides a framework for organizing ecosystem resource information. Examination of organismal attributes within a single watershed that spans more than one ecoregion may allow identification of environmental factors that influence organismal condition. To test this idea, we compared lipid composition of an herbivorous minnow, *Campostoma oligolepis* (central stoneroller), from six sites within the lower Etowah River basin. Half of the sites were primarily within the Piedmont ecoregion where dissolved ion content is low and half were primarily in the Ridge and Valley ecoregion where dissolved ion content is relatively high. Since ion content is related to algal productivity, we expected to see differences in lipid content of stonerollers between the two ecoregions. Between 10 and 20 stonerollers were collected from each of the study sites and returned to the lab. Each fish was measured to length, viscera removed and the remaining tissue homogenized. Lipids were extracted using a modification of the Bligh and Dyer method, dried for 48 hours and weighed on an analytical balance. A second sample was also drawn from the homogenate, dried and weighed, allowing estimation of percent composition. Initial results indicate a strong negative correlation between lipid content and length ($r = -0.385$, $p < 0.05$) across all streams. Analysis by ecoregion indicates this relationship is also significant in Piedmont streams ($r = -0.411$, $p < 0.05$) but not in Ridge and Valley streams ($r = -0.144$, $p > 0.05$).

- P10 CRUZ, ANGEL¹, JOANNA HAWLEY¹, ONA STRIKAS² AND DENNIS HANEY¹. Furman University¹ and Harvard University²—Relationships between urban land cover, stream microhabitat structure, and fish assemblages in the Enoree River watershed of northwestern South Carolina.

The impacts of urbanization on stream hydrology and ecology are increasing rapidly in the southeastern US, but little is known about the more specific effects of urbanization on stream microhabitats and fish assemblages. As such, we measured fish diversity and abundance as well as stream velocity and turbidity in three microhabitats (pools, riffles, runs) at ten stream reaches (designated as primarily rural, residential, or commercial based on land use in the headwaters) in the Enoree River watershed. At each site and in each microhabitat, velocity and turbidity were measured, and fish were collected using a backpack electrofisher and seine. We hypothesized that species richness and diversity would be lowest at the commercial sites, and that the fish assemblages would be more homogeneous among the microhabitats at these sites. Additionally, we hypothesized that stream velocity and turbidity would reflect the greater erodability of the commercial sites. Results showed that species richness and diversity were lowest at commercial sites compared to rural and residential sites, and fish assemblages were more homogeneous among microhabitats at the commercial locations. Abundance was highest in commercial sites, but assemblages were dominated by pioneer species. In addition, species richness and diversity were lowest in riffles at each location. Turbidity was greatest at rural sites, and within runs at all sites. The least variability in velocity among microhabitats occurred at rural sites as compared to commercial and residential sites. Our results show that urbanization negatively affects fish assemblages and alters the composition of the various microhabitats.

- P11 RADER, JESSICA. Middle Tennessee State University—A comparison of stream fish assemblages in adventitious streams of a reservoir and a free flowing river.

Decreased connectivity of streams due to impoundment has been shown to influence stream fish assemblages. Impoundment induced changes in current velocity cause habitat alteration with decreased flow velocities and higher siltation rates upstream of dams and increased flow velocities and substrate scouring downstream of dams. Studies have found that lentic habitats found in the impounded lower reaches of streams attract macrohabitat generalist species and reduce movement of fluvial specialists. The Tims Ford Dam was constructed on the Elk River in Tennessee in 1970 for flood control, recreation, and hydroelectric power generation and resulted in the formation of Tims Ford Reservoir. Results are presented regarding a seasonal study that aimed to assess the impact of the Tims Ford Dam and its reservoir on stream fish assemblages. During the study ten Tennessee streams were surveyed: five adventitious tributaries of the Tims Ford Reservoir and five adventitious streams of the free-flowing Elk River below the reservoir. Multiple regression analysis will be used to determine if the variation in fish assemblages between streams can be explained by the effects of impoundment, seasonal variation, or hydrologic variation between streams. Preliminary study results indicate that macrohabitat generalists (eg. *Lepomis cyanellus*, *Lepomis macrochirus*, *Lepomis megalotis*) are more diverse and abundant in reservoir tributaries and fluvial specialists (eg. *Hypentelium nigricans*, *Moxostoma anisurum*) are more diverse and abundant in river tributaries.

- P12 HOLZER, KATIE¹, SCOTT WARSEN² AND CHRISTOPHER MOWRY³. Lewis and Clark College¹, Calvin College², Berry College³—Measurement of home-range size and activity patterns of coyotes in northwestern Georgia using radio telemetry and camera trapping.

In an ecosystem, top predators can play a disproportionately larger role than other organisms. The coyote (*Canis latrans*), with its newly expanded range into nearly all of North America, is a new top predator in many areas. However, little is known about coyotes in the southeastern United States. This study, conducted on Berry College lands in Floyd County, Georgia, aimed to determine the home-range size and activity patterns of a free-ranging coyote population using two methods: camera trapping and radio-tracking. Camera traps were placed near signs of coyote activity throughout the study area and were used with and without baiting. Five coyotes (three males and two females) were radio-collared and ground tracked daily for ten weeks. The camera traps were active for a total of 241 trap-nights and captured 10 photographs of coyotes for a success rate of 4.15%. Five distinct individuals were identified, although no individual was identifiable in more than one photograph. We used Geographic Information Systems (GIS) to analyze the radio-tracking data and found mean home-range sizes using both the Minimum Convex Polygon (MCP) and Fixed Kernel Density Estimation (FK) methods. With MCP we found mean home-range (\pm SD) to be $13.86 \pm 9.94 \text{ km}^2$, with 95% FK to be $27.51 \pm 9.26 \text{ km}^2$, and the 50% FK core area to be $5.32 \pm 1.32 \text{ km}^2$. We found coyotes to be significantly more active in crepuscular times (dawn and dusk) than during either day or night ($P=0.050$, $P=0.004$), and males to be significantly more active than females ($P<0.001$).

P13 CANCELED

- P14 HENSLEY, NINA M. AND STEPHEN C. RICHTER. Eastern Kentucky University—Population status and genetic variability of two remaining populations of endangered dusky gopher frogs, *Rana sevosia*.

As the human population increases in size, humans continue to encroach on the natural landscape. This reduction and fragmentation of available habitat leads to an overall

decline of populations of non-human organisms. The most severe consequence of this is complete geographic isolation of populations. Isolation leads to genetically reduced populations with no ability to exchange genes or to be recolonized following local extinctions. The Dusky Gopher Frog, *Rana sevosa*, is an endangered species with only two populations remaining. These two populations in southern Mississippi are isolated by a distance of approximately 32 km. The population in Harrison County has had demographic and genetic data collected over the last two decades and is located on protected land in De Soto National Forest. Conversely, the population in Jackson County has unknown status because of its recent discovery and is located on unprotected land. The objectives of this research were 1) to assess the status of the Jackson County population by examining genetic variability and testing for historic population declines and 2) to determine genetic differences between the two populations. Genetic analyses were performed by genotyping individuals of each population for six microsatellite DNA loci. Genetic variability within and between each population was calculated and used to assess status of the species. The results of this research will aid in conservation efforts. One potential is to transfer eggs from the two populations to historic breeding sites. One application of the data obtained is to determine whether we should mix individuals from these populations.

- P15 WINNE, CHRISTOPHER T. AND WILLIAM A. HOPKINS. University of Georgia, Savannah River Ecology Laboratory—Influence of sex and reproductive condition on terrestrial and aquatic locomotor performance in the semi-aquatic snake *Seminatrix pyg.*

Most life history models assume a tradeoff between reproductive investment and parental survival. Several studies have documented reproductive costs in terms of reduced locomotor performance in terrestrial habitats. However, few studies have determined the reproductive costs of pregnancy in aquatic environments or compared pregnancy-induced locomotor costs among habitats. This knowledge gap is important because many organisms rely on multiple habitat types during pregnancy. We compared the relative impacts of pregnancy on locomotor performance in aquatic and terrestrial environments for a semi-aquatic snake (*Seminatrix pygaea*). In addition, because most life history models predict a direct tradeoff between reproductive investment and reproductive costs, we quantified the relationship between reproductive investment and post-partum velocity increase for both habitats. Pregnancy significantly reduced crawling and swimming velocity. Moreover, pregnancy impaired crawling velocity significantly more than swimming velocity. The mean ($\pm 1SE$) percent increases in crawling and swimming velocity after parturition were 72.8 ± 21.6 and $59.4 \pm 12.8\%$ respectively. There was a direct tradeoff between reproductive investment and aquatic locomotor impairment: snakes investing more in offspring experienced larger decreases in swimming velocity. However, evidence for a tradeoff in the terrestrial habitat was weaker. Our results demonstrate that the cost of reproduction for semi-aquatic organisms may differ between aquatic and terrestrial habitats in complex ways. Swimming may be more effective than crawling for escaping predators during pregnancy because swimming results in faster velocities and is less impaired by pregnancy. However, the assumption of a direct tradeoff between reproductive investment and locomotor impairment may be stronger for swimming compared to crawling performance.

- P16 ROWAN, HEATHER AND NICHOLAS SCHISLER. Furman University—Taxonomic status of a coastal population of meadow voles in South Carolina.

The meadow vole (*Microtus pennsylvanicus*), a small to medium sized rodent in the family Muridae, is a globally secure species; however, the World Conservation Union (WCU) states that at least five of 26 subspecies of *M. pennsylvanicus* are of conservation concern and three qualify for protection under the Endangered Species Act (ESA). The subspecies

found in South Carolina, *M. p. pennsylvanicus* appears to be secure in general, but is at the edge of its geographic range in the state where its status is currently unknown. An apparently isolated coastal population in the Charleston area may be of particular concern. This population has not been studied to determine if it represents a unique subspecies worthy of conservation concern or legal protection. To determine its status, we have analyzed the genetic makeup of this population using molecular methods. Ten distinct highly polymorphic microsatellites were identified from previous genetic analyses of *M. oreogaster* and *M. oeconomicus* and fragment analysis was performed to identify unique polymorphisms. High levels of heterozygosity among littermates in the Charleston population of *M. pennsylvanicus* indicates that this population may not be genetically isolated from more northern subspecies. Ongoing assessments of heterozygosity within populations spanning the eastern half of the United States will indicate if the Charleston population of *M. pennsylvanicus* is genetically distinct and thus worthy of protection under the ESA.

- P17 SCULL, GREGORY L., ROBERT CARTER, MARK MEADE, AND JOSHUA TURNER. Jacksonville State University—American Black Bear (*Ursus americanus*) activity in Northeast Alabama.

Historically Alabama had a thriving population of the American black bear. Recently there appears to be a steady rise in the level of black bear activity within and near the federal lands associated with the Shoal Creek Ranger District, Talladega National Forest, Alabama. Black bear are a protected species in Alabama and their elusive nature makes monitoring the species difficult; a non-invasive monitoring program is preferred to prevent stress related to capture. Preliminary efforts using non-invasive genetic sampling (NGS) techniques along with sight and sign surveys were conducted during the summer and fall of 2006. Physical evidence collected includes two front tracks from a juvenile and an adult bear, and scat which indicates that the species is present. Game cameras are being evaluated for use to determine if additional morphometric information can be gathered and hair from scent station surveys has been collected from barbed wire hair snags which is awaiting genetic analysis. Fragment analysis of microsatellite DNA by Amplified Fragment Length Polymorphism (AFLP) will be used for determining population estimation and habitat usage patterns. Data collected from this study will provide natural resource managers, the science community, and the public with important information regarding the life history of this species in northeast Alabama.

- P18 KEANE, ELIZABETH AND HAL BALBACH. University of Illinois at Urbana-Champaign and US Army ERDC-CERL—How can we better manage a southeastern at-risk species?

The gopher tortoise (*Gopherus polyphemus*), a large, land-dwelling turtle is found in parts of six southeastern states. With the advent of plantation forestry, including loss of habitat to urbanization and agriculture, populations are declining throughout their range by about 80%. The species is Federally listed as "Threatened" in Louisiana, Mississippi, and western Alabama, and listing was proposed for the entire range in 2006. Can any one land manager be expected to sustain this species, or reverse the decline of at-risk species, regardless of the amount of land they own? Is there any way to spread the burden of protecting these species? Land managers across the entire range must cooperate and work together to a degree never before seen. At this time, the Army and Department of Defense, with the cooperation of other agencies, state DNRs, TNC, and Gopher Tortoise Council, are proposing such a plan. The route suggested would be through the development of a Candidate Conservation Agreement (CCA) where multiple concerned groups and agencies agree to certain goals and activities in furtherance of the success of the species. To support this, research is being conducted focusing on specific issues important to the success of the tortoise. Through these efforts, a series of guidance

documents are being developed which may be applied by land managers in the region. The goal is to encourage better land management, increasing populations of at-risk species throughout their range. This results in spreading any potential burden, decreasing the dependence on one agency for population recovery.

P19 CANCELED

P20 GODARD¹, RENEE D., C. MORGAN WILSON¹, JESSICA FRICK¹ AND PAUL B. SIEGEL². Hollins University¹ and Virginia Polytechnic Institute and State University²—The effects of environmental exposure and microbial colonization on hatchability of eggs in open-cup and cavity nests.

Many avian species initiate incubation before clutch completion, resulting in an asynchronous hatch of their eggs. Data from several studies that have exposed eggs to natural environmental conditions in artificial cavity nests suggest that asynchronous incubation may preserve the viability of early-laid eggs by protecting them from temperatures that negatively impact development and/or microbial infection. As the effects of environmental exposure of eggs in open-cup nests remain largely unknown, we exposed fertile chicken eggs for 1-5 days in open-cup or cavity nests and compared clutch hatchability to ambient nest conditions and levels of shell microbial growth and internal egg infection. Eggs in half of the cavity and open-cup clutches were cleaned using alcohol in order to reduce microbial growth. There were more temperature intervals above physiological zero in cavity nests when compared to open-cup nests located at the same site. In addition, there was more microbial growth on the shells and higher levels of trans-shell infection of eggs in open-cup nests than those in cavity nests. Cleaning eggs with alcohol did not result in different clutch hatchability; however, open-cup clutches had lower hatchability than those in cavity nests. Our findings suggest that the microclimate of open-cup nests may be more conducive to microbial growth, particularly if exposed to rain events, when compared to cavity nests. Further, our data suggest that open-cup nesters may face constraints on reproduction different from those that cavity nesters face, and therefore may make choices regarding incubation that reflect these challenges.

Animal Physiology

P21 LOBATO, DENAE N., CHRISTINA E. WHEELER, C. MORTAN WILSON AND RENEE D. GODARD. Hollins University—Determining the duration of the adrenocortical response in the House Sparrow, *Passer domesticus*.

Acute corticosterone secretion may direct an individual toward immediate, life-sustaining activities until circumstances improve. However, little is known about the duration of the acute adrenocortical response after perturbation ceases. Thus, we measured the adrenocortical response (blood samples at 0, 15, 30 and 60 min) of wild-caught House Sparrows (*Passer domesticus*) and then kept them in captivity. After 4 weeks, birds were again sampled for the adrenocortical response and then left undisturbed for 1, 2, or 3 h, after which an addition sample was taken. The adrenocortical responses of wild-caught and captive birds differed by: 1) baseline corticosterone was significantly elevated in captive birds, and 2) captive birds' corticosterone returned to baseline *during* the handling paradigm. Moreover, corticosterone remained at baseline after the undisturbed period. Elevation of baseline corticosterone may reflect poorer body condition; however, our sparrows showed no change in energetic condition (mass/tarsus³) from field to lab. Therefore, captive conditions may have elicited a chronic elevation in baseline corticosterone but influenced rapid hormonal recovery during an event that was not ultimately life-threatening. These data suggest that caution should be practiced when comparing the adrenocortical responses of free-living and captive populations. Because

our results differ from the adrenocortical responses of other free-living birds held in captivity, we are currently repeating this study. Ultimately, we hope to gain a better understanding of the duration of the acute adrenocortical response after perturbation ends, as chronic elevation of corticosterone has numerous negative physiological and behavioral effects.

- P22 ZHANG, YING, MARJORIE C. WESTFALL, KATHLEEN C. HERMES AND MICHAEL E. DORCAS. Davidson College—Physiological and behavioral control of heating and cooling rates in rubber boas, *Charina bottae*.

Body temperature directly impacts the ecology, behavior, and physiology of many reptiles. Consequently, many reptiles thermoregulate to optimize physiological functions. Some reptiles have the ability to behaviorally and physiologically control their rates of heat exchange through postural adjustments and regulation of blood flow. Because studies of heating and cooling rates have been performed on a limited number of species, studies of other taxa are needed to provide a more thorough understanding of reptilian thermoregulation. In this study, we examined the ability of rubber boas (*Charina bottae*) to physiologically and behaviorally control their heating and cooling rates. We measured the heating and cooling rates of rubber boas between 5° and 35° C with constrained and unconstrained postural treatments. In both the unconstrained and constrained treatments, heating rates were significantly faster than cooling rates (ANCOVA; $p=0.001$). We did not find a significant difference between constrained or unconstrained heating rates, although constrained cooling rates were somewhat slower than unconstrained cooling rates (Tukey test; $p=0.059$). Furthermore, we found a marginally significant inverse relationship between mass and thermal time constants with larger snakes heating and cooling more slowly than smaller snakes (ANCOVA; $p=0.067$). Thus, it is apparent that rubber boas can physiologically control their heating and cooling rates. However, the ability of rubber boas to alter their heating and cooling rates via postural adjustment remains equivocal. Overall, our results provide a greater understanding of physiological thermoregulation in rubber boas and further insight into the mechanisms of reptilian thermoregulation.

- P23 GIARDINA, ANDREA, JOHN WHEELER AND SANDRA F. LARSON. Furman University—Long-term and acute effects of zinc contamination of a stream on fish mortality and physiology.

A section of the Upper Enoree River in South Carolina was contaminated with chemical waste in 1985, and high concentrations of zinc persist decades later. This study examined the distribution of fish populations downstream of the spill site, the accumulation of zinc in a variety of fish tissues, and the mortality rates of introduced fish. Water samples collected from six sites along the stream indicate that zinc concentrations in the water decreased as distance from the spill site increased ($P<0.0001$). No native fish were found within the first 500 m downstream of the spill site. To further evaluate the ability of fish to survive at the different sites, groups of fish were placed in traps at a control site (uncontaminated local tributary), a site ~200 m downstream of the spill (no native fish found) and the two upstream-most sites where native fish were found. Rapid mortality was observed in the two sites closest to the spill, including one site where native fish had been found. A previous study showed that the gonads accumulated less zinc than liver. In this study, zinc content in muscle and gonad tissue was compared to see whether low gonad mass-specific concentrations of zinc in the previous study reflected a tissue-specific mechanism designed to protect the gametes. As noted previously, zinc content was higher in livers than gonads ($P=0.02$) across all sites, however zinc content in gonads and muscles did not differ ($P=0.43$), thus the protective mechanism hypothesis was not supported.

- P24 KEMP, CLAIRE, CANDACE LINDLER AND THOMAS C. ALLEN. North Greenville University—Investigation of an estrogen stimulated, chemotactic factor for eosinophils in the rat uterus using an unique *in situ* model.

Eosinophils impede parasitic invasions and play a part in the allergic inflammatory response. Interestingly, eosinophils have been demonstrated to migrate to the rodent uterus during estrogen stimulation. The physiological mechanism of this process has not been clearly delineated. To date, *in vitro* or *in vivo* techniques have been used to determine the presences of an eosinophil chemotactic factor. whose synthesis in the rat uterus seems to be under the control of estrogen(s). To investigate this phenomenon, Sprague-Dawley host rats were ovariectomized and injected with estradiol (E2), estrone, estriol, hydrocortisone, progesterone, or vehicle-control. Hormone-treated animals were sacrificed 4 hrs after final injection. Medial sections were taken from the uterine horns and histologically analyzed for eosinophils. The remaining portions of uteri were homogenized in Tris buffer, centrifuged, and the supernatants frozen (-186 C). Thawed supernatants from various hormone-treated uteri were injected directly into one uterine horn of recipient, ovariectomized rats, while the vehicle-control uterine homogenates were injected into the contralateral uterine horn (*in situ*) and incubated for 1 hr. Recipient uterine horns were examined histologically for eosinophils using diaminobenzidine stain. E2 caused the most pronounced migration of eosinophils in both the *in vivo* and the *in situ* model. The *in situ* model is an effective method for analyzing the hormonal regulation of eosinophil migration to the uterus. This study suggests that the chemotactic factor: 1) is under the control of E2; 2) is present in the uterine homogenate of an ovariectomized rat subsequent to E2 replacement therapy; 3) is stable in low temperature storage; and 4) can illicit an eosinophil response within 1 hr. of recipient, uterine incubation.

Herpetology

- P25 GRAY, NICOLE¹, RICCARDO FIORILLO², KODY CHASE³ AND THOMAS MCELROY¹. Kennesaw State University¹, University of Louisiana Monroe², Shorter College³—Genetic structure and parentage analysis of the marbled salamander, *Ambystoma opacum*, in Marshall Forest, Rome, GA.

There are many factors involved in the unprecedented worldwide decline of amphibian populations. The most obvious factors are habitat destruction and alterations such as clear cutting and draining of wetlands. Other factors include disease, global environmental change, as well as contaminants. Amphibians are a good indicator species for assessing environmental quality. They are characterized by permeable skin and a biphasic life-cycle, which makes them sensitive to environmental disturbance. One method for determining the overall diversity and population health in amphibians is to monitor their breeding sites. Since December of 2003 we have monitored a vernal pond in Marshall Forest which serves as a breeding site for many amphibians, including the marbled salamander. Adult male and female salamanders were captured as they entered the pond in the fall. The juveniles were captured as they left in late spring. Captured individuals were measured, weighed and photographed. A one centimeter portion of the tail was kept for genetic analysis. The salamanders were then released. We surveyed 5 polymorphic microsatellite loci in each individual. The amplified products were electrophoresed on an ABI 310 automated DNA sequencer. Parentage analysis and population genetic structure indicted a general skew in reproduction for this population. This may be the result of selection on life history characters or other aspects of the salamander's reproductive biology; however, genetic drift could not be excluded.

- P26 WESTFALL, MARJORIE C., KRISTEN K. CECALA, STEVEN J. PRICE, AND MICHAEL E. DORCAS. Davidson College—Patterns of Trombiculid mite (*Hannemania* sp.) parasitism among Plethodontid salamanders in the western Piedmont of North Carolina.

Parasites can greatly impact the lives of their hosts; affecting growth, reproduction, and behavior. North American woodland and streamside salamanders (Family Plethodontidae) serve as hosts to the Trombiculid mite of the genus *Hannemania*. In this study, we investigated patterns of *Hannemania* sp. parasitism of salamanders in the western Piedmont of North Carolina. Specifically, we 1) compared the abundance of mites among three plethodontid salamander species (*Eurycea cirrigera*, *Desmognathus fuscus*, and *Plethodon cylindraceus*), 2) determined the locations of mite parasitism on salamanders' dermis, 3) evaluated the relationship between salamander snout-vent length (SVL) and mite abundance, 4) compared mite abundance among geographic locations, and 5) measured seasonal variation in mite abundance. We found that all three salamander species were parasitized by Trombiculid mites. *Desmognathus fuscus* generally harbored a greater mean abundance of mites (60.4% parasitized) than either *E. cirrigera* (11.1%) or *P. cylindraceus* (14.6%) ($p < 0.001$). The greatest concentration of mites on body parts of both *D. fuscus* and *P. cylindraceus* occurred on the limbs ($p < 0.001$), however there was no correlation between SVL and parasite abundance ($p = 0.689$). Geographic location influenced the abundance of mites on both *D. fuscus* and *P. cylindraceus* ($p = 0.002$). Finally, we found no effect of season on mite abundance in *D. fuscus* ($p = 0.952$). Our study provides a greater understanding of the patterns of ectoparasitism among salamander species, and adds information to the natural history of both Trombiculid mites and salamanders in the western Piedmont of North Carolina.

- P27 DIEFENBACHER, ERIC H., KATHRYN R. PAWLIK AND THOMAS K. PAULEY. Marshall University—Morphological examination of Green Salamander (*Aneides aeneus*) toe discs.

Organisms such as insects, geckos, and frogs exhibit amazing adhesive properties on their limbs. It was not until recently that biologists started to unravel the structures and mechanisms behind these unusual adaptations. Insects use a combination of flexible cuticles, arolium, and pretarsal claws to cling to objects; frogs use mucous glands to form wet adhesion; and geckos employ scansors with rows of setae containing spatulae which create van der Waals forces to adhere to various surfaces. Virtually no studies have been done on possible adhesive structures of arboreal salamanders. In this study, we examined the distal digital toe disc structures of the arboreal Green Salamander, *Aneides aeneus*, which are known to climb vertical surfaces such as trees and rock outcrops. While toe discs are hypothesized to be an adaptation to a climbing lifestyle, no studies have been done to describe this structure or the possible adhesive mechanisms that may accompany this behavior. Preliminary scanning electron micrographs confirm the presence of a suction cup-like structure on the distal tip of each digit. This structure appears to contain a hard yet flexible outer "ring," lending to the disc shape of the toe, with a soft center covered in dermal tissue. Internal anatomy of observed structures was examined using histology and stained using hematoxylin and eosin. Further investigation into these structures will help us gain a better understanding of its morphology and how this species exploits certain habitats.

- P28 JAEGER, COLLIN P., CARRIE A. CASTEEL, JAKE A. PRUETT AND VINCENT A. COBB. Middle Tennessee State University—Spatial ecology of two turtle species on Reelfoot Lake.

To better understand the spatial ecology of Southern Painted Turtles (*Chrysemys picta dorsalis*) and Red-eared Sliders (*Trachemys scripta elegans*) in a large lake system, we

monitored seasonal movements and site selection using radiotelemetry. From late May through mid June 2006, we captured ten *C. picta* and ten *T. scripta* (all female) and attached transmitters to their posterior carapace. Turtles were then returned to the lake and re-located every 2-3 days during the active season and once every two weeks during the winter. At each location, we recorded map coordinates using a handheld GPS and the distance from shore using a laser rangefinder. During the active season, *T. scripta* moved more frequently and over greater distances than *C. picta*. (mean = 166.8 and 82.1 m/day, respectively). Also, *T. scripta* selected sites further from shore, whereas the *C. picta* were located closer to the shoreline (means = 83.6 and 3.8 m, respectively). Preliminary estimates also indicate that *T. scripta* maintains a larger home range than *C. picta*, and that both species have home ranges larger than previously documented. Most spatial studies have been conducted in relatively small bodies of water, possibly limiting the home ranges of these species. Our findings indicate that spatial utilization may be dependent upon the size of the aquatic system.

- P29 CHASE, KODY¹ AND RICKY FIORILLO². Shorter College¹ and University of Louisiana Monroe²—Life history and reproductive ecology of *Ambystoma opacum* in a seasonal pond.

Temporary ponds are crucial breeding habitat for many amphibians. Since January 2004, we have been monitoring reproduction in a population of marbled salamander, *Ambystoma opacum*, in a small seasonal wetland in Marshall Forest, Rome, GA. *Ambystoma opacum* is the most common salamander in this pond and a fall aggregate breeder. We have used digital photography to identify individuals as they return to the pond for breeding. Here we report data on body size, pond residency time, reproductive investment and time and body size at metamorphosis. We also examine the influence of hydro-period length on the number and size of metamorphs. Recapture data suggests that most females remain on their nest until the pond is flooded, while males are recaptured leaving the pond soon after the first females arrive and well prior to pond flooding.

- P30 CECALA, KRISTEN K., STEVEN J. PRICE AND MICHAEL E. DORCAS. Davidson College—Seasonal activity and movement of larval Red Salamanders (*Pseudotriton ruber*).

Life history parameters such as activity, movement, and survivorship have been extensively studied in pond-breeding amphibians, but only limited research has focused on stream-breeding amphibians. Life history parameters are especially important to study in species that spend multiple years as larvae and may be subject to variable environmental conditions within streams. We sought to examine seasonal activity and movement patterns of larval red salamanders (*Pseudotriton ruber*) within a stream ecosystem. From May until November, 2006, we systematically sampled the entire length of a 150 m first-order stream, uniquely marking each captured salamander. Using number of daily captures as a measure of activity, we found that activity varied monthly ($p < 0.001$) with larvae apparently most active in June and least active in November ($p < 0.001$). We found widespread movement within the stream by all age cohorts with 39% of recaptured first year larvae, 37% of recaptured second year larvae, and 50% of recaptured third year larvae moving greater than 5 m from their original capture location. Higher recapture rates for larger individuals (46%) than smaller individuals (28%), indicates that survivorship appears to vary among age cohorts. Our data suggest that activity varies temporally and may affect larval salamander movements and survivorship within stream ecosystems.

- P31 HARDEN, LEIGH ANNE¹, NICK A. DILUZIO¹, J. WHITFIELD GIBBONS² AND MICHAEL E. DORCAS¹. Davidson College¹ and Savannah River Ecology Laboratory²—Spatial and thermal ecology of diamondback terrapins (*Malaclemys terrapin*) in a South Carolina salt marsh.

Since the 1980's, east coast barrier islands such as Kiawah Island, South Carolina, have experienced rapid urbanization resulting in alteration of their salt marsh ecosystems. These estuarine ecosystems serve as critical habitat for numerous endemic wildlife species such as diamondback terrapins (*Malaclemys terrapin*) which, because of their high site fidelity, may be particularly vulnerable to anthropogenic disturbances. To better understand the interactions between terrapins and their environment, we initiated an intensive six-day radiotelemetric study to investigate the daily movements and habitat use of five terrapins within a tidal creek. In conjunction with radiotelemetry, we used microdataloggers to continuously monitor both terrapin and environmental temperatures. We found that during high tides, low tides, and ebbing tides, terrapins spent more time in the marsh (*Spartina* sp., mud, and occasional shallow water) than in open water of the creek channel. Terrapins moved a mean total distance of 750 m with individual total distances moved ranging from 440 to 1159 m. The mean straight-line distance between the two farthest points was 642.5 m with individual straight-line distances ranging from 287 to 1035 m. We were able to recover micro-datalogger temperature information from two male terrapins and found that from 13 May until 1 June 2006 terrapin carapace temperatures varied from 16.0 to 41.0 C. Comparing these temperatures to environmental temperatures allowed us to make detailed inferences about basking behavior. Our short radiotelemetry study provides new insight to understanding diamondback terrapin habitat use, which will assist in developing predictive models to estimate population sizes.

- P32 STACY, JODI AND PAUL V. CUPP, JR. Eastern Kentucky University—An evaluation of artificial cover objects in monitoring Plethodontid Salamanders in Central Kentucky.

To sample terrestrial salamanders, artificial cover objects (ACOs) have been proposed to alleviate problems associated with traditional methods. Though employed in many monitoring programs, studies evaluating ACOs are scarce. To evaluate the effectiveness of ACO searches versus natural cover object (NCO) searches to detect terrestrial salamanders in central Kentucky, two grids (one ACO grid and one NCO grid) were established at six study sites. At each study site, a NCO grid, consisting of naturally occurring flagged NCOs, was spaced 5 m apart from an ACO grid containing 60 ACOs (plywood 30.4 x 30.4 x 0.5 cm). Searches under both cover object types encountered most of the same species; however, a greater species abundance was detected under ACOs. Seven and six species from three genera were encountered under ACOs and NCOs, respectively, with the long-tailed salamander (*Eurycea longicauda*) being the only species not detected under NCOs. Among seasons, encounter rates were significantly greater under ACOs. Within seasons, encounter rates were significantly greater under ACOs in the summer and spring but not in the fall and winter. Though sampling protocol likely impacted encounter rates under NCOs, it appears that ACOs effectively replicated the microhabitat of NCOs for several species. This study suggests that ACOs may provide accurate indices of abundance for *Plethodon* species and be a reliable tool for investigators wishing to comprise a species list for a given area. Future studies should focus on employing different wood types and sizes of ACOs to better replicate the microhabitat of NCOs.

- P33 CASTEEL, CARRIE A., COLLIN P. JAEGER AND VINCENT A. COBB. Middle Tennessee State University—Reproduction of three freshwater turtle species at Reelfoot Lake.

Details of an organism's reproductive characteristics are important when considering conservation and management efforts for that organism. As part of a larger project on the population ecology of freshwater turtles at Reelfoot Lake, we determined the timing of egg shelling, gravidity percentages, clutch sizes, and body size/clutch size relationships for

three turtle species over two years. We captured turtles using hoop nets throughout May-October 2005 and 2006. We gave each turtle individual ID marks and recorded body sizes and masses of each. Adult females (308 Painted Turtles (*Chrysemys picta*), 258 Red-eared Sliders (*Trachemys scripta*), and 513 Stinkpots (*Sternotherus odoratus*)) were palpated and/or x-rayed to determine gravidity and clutch size. All three species began shelling eggs between 8-20 May 2005-06. No turtles with shelled eggs were detected after 1 August 2005 and 11 July 2006. *Chrysemys picta* and *T. scripta* displayed higher percentages of gravidity early in the reproductive season, while *S. odoratus* displayed a normal distribution. Mean clutch size did not differ by year (*C. picta* = 6.3; *T. scripta* = 12.8; *S. odoratus* = 3.7). Only *S. odoratus* exhibited a significant, positive relationship between carapace length and clutch size ($r^2 = 0.392$). Reelfoot Lake is the only body of water in Tennessee with no harvest limit for freshwater turtle species. These results will be important in the assessment and establishment of freshwater turtle harvest regulations at Reelfoot Lake.

P34 SCHULTZ, JESSICA J. AND KEVIN M. GRIBBINS. Wittenberg University—Spermiogenesis within the testis of the Jamaican anole, *Anolis lineatopus*.

The ultrastructural steps of spermiogenesis within the Jamaican anole are described in this study. Standard TEM techniques were performed on testicular tissue collected from anoles sampled during each month of the year (n=48). A proacrosomal granule produced from a juxtapositioned Gogli develops during acrosome formation. Nuclear condensation during elongation follows the pattern described for others lizards. Fine filamentous chromatin is replaced with course dense granules that arise from nucleosomes within the nucleoplasm. The basal nuclear surface forms a fossa where the proximal centriole of the tail is anchored to the nuclues. The midpiece houses many mitochondria, which form a concentric ring around the flagellum. There is no manchette present during the elongation of the nucleus. This is the 1st description of reptilian spermiogenesis where the manchette is not found during elongation. Also, the acrosome has multiple layers to its membrane structure. There are up to 3 layers present within the inner and outer acrosome membranes. These layers, if present in mature spermatozoa, may aid in the compartmentalization of the acrosome and affect the sequence of events that lead to the release of its enzymes during fertilization. These data are similar to the findings of other reptilian and avian species and support previously reported phylogenetic relationships using spermatid morphology. However, the lack of a manchette and the multiple-layered acrosome are features that may be unique to anole spermiogenesis. If these characteristics hold true for other anole species then they may be useful in helping sort out the phylogenetics of Sauria.

P35 BARNES, SHELLY L. AND KEVIN M. GRIBBINS. Wittenberg University—Evidence of a conserved temporal germ cell development strategy within the continuous breeding male anole, *Anolis lineatopus*.

Spermatogenesis in reptiles is typically seasonal. Most temperate species are highly asynchronous and produce sperm during the warmer months of the year. Similar information suggests that many tropical species regardless of elevation practice seasonal sperm development in response to differences in rainfall. A recent study on the equatorial lizard, *Sceloporus bicanthalis*, provides evidence for continuous spermatogenesis with no seasonality. The purpose of this study is to investigate spermatogenesis within the tropical anole, *Anolis lineatopus*, and compare its germ cell development and seasonality to that of other temperate and tropical reptiles. Anoles were collected monthly in Jamaica from October 2004 to October 2005 (N=48). Three mm pieces of testis were fixed in glutaraldehyde, dehydrated with ethanol, embedded in Spurr's plastic, sectioned (2µm) with an ultramicrotome, and stained with toluidine blue. Histological observations indicate that Jamaican anoles exhibit spermatogenesis and spermiogenesis throughout the year.

Spermatogonia, spermatocytes, and spermatids at various stages of development were observed within seminiferous epithelia of every month sampled. Mature spermatozoa were also found in the lumina of seminiferous tubules in every month anoles were collected. There was no evidence of spatial stages, which is a characteristic of amniotic spermatogenesis. Many temperate reptiles have the same temporal pattern of sperm development found in this anole. This data suggests that reptiles may exhibit temporal development no matter their seasonality preferences. A temporal germ cell development strategy represented in both seasonal and continuously breeding reptiles within a structurally amniotic testis represents an intermediate testicular model that may be phylogenetically significant.

- P36 RHEUBERT, JUSTIN L. AND KEVIN M. GRIBBINS. Wittenberg University—A preliminary light microscopic study of spermatogenesis within the testes of the Cottonmouth snake, *Agkistrodon piscivorus*.

Cottonmouth (*Agkistrodon piscivorus*) testes were examined histologically to determine the germ cell development strategy employed during spermatogenesis. Testicular tissues from Cottonmouths were collected monthly (n=36) from swamps around Hammond, Louisiana. Pieces of testis were fixed with glutaraldehyde, dehydrated with ethanol, embedded in Epon812, sectioned with an ultramicrotome, and stained with toluidine blue. Spermatogenesis within Cottonmouths occurs in all months of the year. Though spermiation was most heavily observed March-May and October/November. These data correspond to previous reports on Cottonmouth populations from Florida. During spermatogenesis no consistent spatial relationships were seen between germ cell generations. Typically, either spermatogonia or spermatocytes were missing or 3 or more spermatids were present within cross sections of seminiferous tubules, which prevented consistent spatial stages from occurring. This is similar to what has recently been reported for other temperate squamates. This temporal pattern of sperm development is different from birds and mammals. The pattern of sperm development within Cottonmouths is more reminiscent of that seen in amphibians. Swamp snakes (*Seminatrix pygaea*) have a similar germ cell development strategy, however spermatogenesis is more seasonal and restricted to April-October. This study is the first to describe a temporal sperm development within a temperate species of reptile that practices continuous spermatogenesis. To date, no matter the seasonality of the temperate reptile studied, all show the same temporal pattern of sperm development. This conserved sperm development (similar to amphibians) within a structurally amniotic testis (like mammals and birds) might represent an intermediate testicular model that may be evolutionarily significant.

- P37 SCOTT, A. FLOYD¹ AND WILLIAM H. REDMOND². Austin Peay State University¹ and Dog Hill Farm²—Occurrence records for reptiles in Tennessee: sources, historical development, and geographic distribution.

Occurrence data for reptiles in Tennessee were obtained and verified on visits to 25 museum collections throughout eastern United States. Additional information was gathered from personal field work and via a thorough search of the literature (including the gray literature and abstracts only) dating from 1835. Museum records and personal collections totaled 9827, representing 10,738 specimens; the literature search identified 412 documents that included 2851 references to reptiles in the state. Reports of 64 species of extant reptiles in Tennessee appear in the literature, but only 56 are considered native. The other eight likely are based on encounters with escaped exotics, misidentified specimens, or corrupted locality data. Museum specimens with Tennessee locality data date back to 1855 and represent 57 species, one of which is questionable. Numbers of records and species per county appear related to the proximity of accessible public lands and/or institutions of higher learning. Funding for this project came from three sources:

Austin Peay State University's Center for Field Biology, the Tennessee Wildlife Resources Agency (CARA funds), and the Tennessee Herpetology Society.

- P38 PARKER, NATHAN L. AND A. FLOYD SCOTT. Austin Peay State University—Recent invasion of the Green Treefrog, *Hyla cinerea*, into upland regions of Southeastern United States.

The distribution of the Green Treefrog, *Hyla cinerea*, has historically been considered closely tied to the Atlantic and Gulf Coastal plains of the southeastern United States. Surveys of sites in Kentucky and Tennessee conducted beginning June 2006, combined with historical data indicate that this species has been progressively invading upland ecoregions adjacent to the Coastal Plain in the period 1980-present, with much of the expansion occurring in the last 10 years. Formerly known only from the lowermost 65 river miles and from a small stretch near river mile 370, populations of this species may now be present throughout the lower 420 river miles of the Tennessee River in Kentucky, Tennessee, and Alabama. Dramatic range expansions have also occurred in the Cumberland and Ohio valleys in Tennessee, Kentucky, and Indiana, and in the Piedmont of South Carolina and Georgia. Efforts are made to describe the probable historical and current ranges of the species and possible reasons for its recent range expansion. This project was funded by The Center for Field Biology at Austin Peay State University.

- P39 ANDERSON, WESLEY M., STEVEN J. PRICE AND MICHAEL E. DORCAS. Davidson College—Aspects of the natural history of rat snakes (*Elaphe alleghaniensis*) in the western Piedmont of North Carolina.

Rat snakes (*Elaphe alleghaniensis*) have a large geographic range, extending from southeastern Ontario west to Kansas and south to the Gulf Coast of Texas. Because of their broad geographic range, rat snake populations may vary significantly in natural history characteristics. The objective of this study was to examine aspects of the natural history of *E. alleghaniensis* in the western Piedmont of North Carolina, primarily in Mecklenburg and Iredell counties. Using multiple sampling techniques, we captured 180 *E. alleghaniensis* from 1999-2006. Morphological and locality data for each individual was recorded and a PIT-tag implanted into non-juveniles. Twelve of these PIT-tagged individuals were recaptured at least once. We captured slightly more females (54%) than males (44%) with the remaining 2% comprised of unsexed juveniles less than 400 mm in snout-vent length. Female *E. alleghaniensis* appear to become active earlier in the year as they have been captured three times as frequently as males during the month of April. Overall, sexually mature adults measured between 915 mm and 1550 mm snout-vent length with approximately half of these individuals between 1000 and 1200 mm. Results of this study provide a better understanding of regional morphological and natural history variation in this wide-ranging species.

- P40 CLINE, GEORGE, JAMES RAYBURN AND CLIFFORD WEBB. Jacksonville State University—Snorkel/scuba survey of historic hellbender streams (What to do when hellbenders don't come?).

Hellbenders (*Cryptobranchus alleganiensis*) are large aquatic salamanders found in fast flowing streams. Researchers have detected declines in populations from throughout the species range. In Alabama, they are restricted to the Tennessee River drainage system where they are listed as a Priority 1 species (highest conservation concern). In October 2005, we began a survey of historic sites in three Alabama Counties north of the Tennessee River. Surveys were conducted by flipping rocks while walking, snorkeling, and scuba diving, stream stretches and later, by trapping. No hellbenders were observed during 20 site surveys. Discovery of a dead hellbender late in 2006 caused us to change or survey strategy to include live trapping, but these efforts were limited and have been

unsuccessful to date. Physical and chemical characteristics of these streams are as follows. Flow rates ranged from 3.6 – 129.1 cm/s. These waters ranged from neutral to slightly alkaline (pH 7.00-8.12). Conductivity was relatively low at these sites (29-177 us/cm) indicating low dissolved ion concentrations. Dissolved oxygen and temperature are in the good range for these waters (49-100% DO; 4.5- 8.9 mg O₂/l; 15.32-29.9 °C). These streams are fairly clear (turbidity 3-59 NTUs), but there was considerable siltation at most sites. Water quality is high enough to support pollution in-tolerant species such as crayfish (a major component of hellbender diets) and queen snakes (*Regina septemvittata*). These survey techniques have produced hellbenders in neighboring states living under similar conditions. More extensive surveys with increased trapping are planned for the next activity season.

- P41 SCHNEIDER, AMY, AMY HAMILTON AND THOMAS K. PAULEY. Marshall University and Mead Westvaco Corporation—A continued study of the use of man-made ponds for amphibian breeding in fragmented forested areas.

Amphibian populations are declining worldwide due to factors such as habitat degradation, fragmentation and destruction. We conducted a study to explore the use of man-made ponds in a forested habitat by breeding amphibians, specifically *Rana sylvatica* and *Ambystoma maculatum*. The objective was to examine the movement of these animals after leaving the ponds and the survival and movement of juveniles. Nine ponds were constructed in December 2002 in the MeadWestvaco Wildlife Ecosystem Research Forest (MWERF) in Randolph County, West Virginia. Three fragmentation treatments; clear cut to one hectare surrounding a pond, clear-cut to one hectare surrounding a pond with forested corridor, and no treatment; were cut in two compartments in August 2006. Drift fences with funnel traps surrounded each pond to monitor amphibian movements. All amphibians captured were batch marked with pond specific tags using visible implant elastomers (VIE). No amphibians bred in the ponds in 2003, therefore the ponds were stocked with *R. sylvatica* and *A. maculatum* egg masses from nearby permanent pools. Thirty *R. sylvatica* juveniles and three *A. maculatum* juveniles emigrated from the ponds in 2005. Only five *R. sylvatica* juveniles and no *A. maculatum* juveniles had emigrated from the ponds in 2006. Five *R. sylvatica* adults were fitted with radio transmitters and tracked for ~35 days to determine movements after leaving the breeding ponds. *R. clamitans melanota*, *Notophthalmus v. viridescens*, *R. catesbeiana*, and adult *R. sylvatica* populated the ponds after the breeding season. Monitoring will be continued in successive seasons and post-cut data will be compared.

- P42 MCCOARD, NOAH S., KERIE Y. CORLEY AND THOMAS K. PAULEY. Marshall University—Effects of water pH and ultraviolet radiation on the reproductive success of Wood Frogs (*Rana sylvatica*) in high elevations of West Virginia.

Wood Frogs (*Rana sylvatica*) were monitored in a high elevation wetland in West Virginia to determine potential effects of pH and UV radiation. The study site located at 3120 ft includes a large beaver pond with large standing spruce trees, and sphagnum moss. Wood Frogs were the predominate species of amphibian in the study area. Hundreds of Wood Frogs migrated to the wetland, mated and deposited eggs, however during two years of observation from 1995 to 1996 no reproductive success was observed. Wood Frogs have been found to have a high pH tolerance, however pH values of 3.5 and lower are lethal and pH values of 3.5 to 3.9 have shown a 50% reproductive success rate. According to historical records at our study site there has been a drop in pH, however this drop should not be lethal to Wood Frogs. The average pH from 1946-1951 was 4.75, and from 1957-1985 4.12, while the average pH from 1995 and 1996 was 4.05. Other factors may have contributed to the lack of reproductive success such as ultraviolet radiation. We hypothesize that UV radiation and low pH in the high elevations of West Virginia alone are not lethal but when combined together can result in mortality.

- P43 MALONEY, JOSHUA L. AND A. FLOYD SCOTT. Austin Peay State University—A study of amphibian populations inside and outside a Combined Sewer Overflow drainage in Montgomery County, Tennessee.

Combined Sewer Overflows (CSOs) carry both sanitary sewage and storm-water runoff. When the carrying capacity of the system is exceeded some of the mixture of sewage and water may overflow and find its way into streams and other bodies of water in the surrounding drainage basin. This study looked at the amphibian fauna along a first-order stream in a CSO drainage basin of Clarksville, Tennessee and compared it with that of two other streams of similar size and character: 1) another urban stream in an adjacent drainage of Clarksville that had separate sewage and storm-water systems and 2) an Environmental Protection Agency reference stream in a rural setting 20 km to the southeast. Sampling involved time-constrained searches that were conducted in spring, summer and fall at three sample sites along each stream from October 2004 through July 2006. Species richness of salamanders was lowest in the CSO drainage and highest in the reference stream but no significant difference was detected between or among any of the sites. Frogs were absent in both of the urban streams, but were numerous in the reference stream, representing 6 species. Abundance of individuals (excluding the frogs) was lowest in the CSO drainage, somewhat greater in the adjacent urban stream, and highest in the rural reference stream. Results indicate that amphibian abundance in an urban setting is lower in streams with CSOs than in those where sewage and storm water are conveyed separately. Also suggested is a richer and more abundant amphibian fauna in rural versus urban drainages. Funding for this project was provided by a grant from the Clarksville Gas and Water Department.

- P44 JOHNSON, EMMY, AMY SCHNEIDER AND THOMAS K. PAULEY. Marshall University—Response of forest salamanders to Diflubenzuron treatments as a method to control Gypsy Moths.

The purpose of this study was to determine if application of the insecticide Diflubenzuron negatively impacts forest salamanders, *Plethodon cinereus*, *Desmognathus ochrophaeus*, and *D. monticola*. Potential effects were observed by examining the number and volume of mature follicles, tail fat percentage, and stomach contents. Four watersheds, 2 treatment and 2 controls, within the Fernow Experimental Forest, Tucker County, West Virginia were used as experimental sites between 1989 and 1993. Diflubenzuron was applied to 2 watersheds in 1992. Three years of pretreatment data and 2 years of posttreatment data were collected. The diet of *D. monticola* shifted from soft-bodied prey to hard-bodied prey after treatment, but not in untreated watersheds. The diet for *P. cinereus* and *D. ochrophaeus* also shifted, but in both untreated and treated watersheds. There was a significant increase in carcass fat and total weight for both terrestrial species after treatment in both treated and untreated watersheds. There was no significant difference in tail fat, carcass fat, or total fat of all species between the watersheds. The volume and number of follicles and snout-vent length also had no significant difference between the watersheds. Our study revealed that Diflubenzuron had no apparent effect on terrestrial or stream salamanders. A possible problem was that the length of the study was not adequate to observe the effects of Diflubenzuron on future generations of salamanders.

- P45 MORAN, DOUGLAS, DYKSTRA FREEMAN AND JONATHAN AKIN. Northwestern State University of Louisiana—A FETAX analysis of the effects of atrazine on development of *Xenopus* tadpoles.

Atrazine is a common herbicide widely applied in US agriculture. We investigated the potential teratogenic effects of atrazine on tadpole development in *Xenopus*. Using

FETAX, we found that atrazine exposure did produce deformities at concentrations that are lower than commercial formulations used in agriculture. Nonetheless, these findings suggest that amphibian populations may be affected by agricultural runoff.

- P46 BALDWIN, TIMOTHY E. AND THOMAS K. PAULEY. Marshall University—Ecology and distribution of Rough Greensnakes and Smooth Greensnakes (*Opheodrys aestivus* and *Opheodrys vernalis*) in West Virginia.

Since 1971, documented Rough Greensnake (*Opheodrys aestivus*) occurrences in West Virginia have declined from approximately 100 to less than 20 occurrences in the last 10 years. In contrast to the decline of Rough Greensnakes in WV, Smooth Greensnake (*O. vernalis*) populations appear to be stable over the same period of time. Historic sites from the West Virginia Biological Survey were cross referenced with habitat descriptions in published literature to establish research locations. During Summer 2006, 41 Smooth Greensnakes and 10 Rough Greensnakes were captured. During Fall 2006, 78 preserved snakes were examined. Plant community data were collected at each collection site (N=51) to define their habitat characteristics along 100m transects. Morphometric measurements such as snout-to-vent length were taken for captured and museum specimens (N=119). The stomachs of field-captured specimens were flushed to identify prey; preserved specimens were dissected. Of the 6 month active period, Rough Greensnakes had the most captures in September, accounting for 30%. In comparison, Smooth Greensnakes had the most captures in June, accounting for 33%. Exponential regression showed a positive correlation between total length and weight for Smooth Greensnakes ($R^2 = 0.9136$) and Rough Greensnakes ($R^2 = 0.7124$). Species occupied different habitats, with Rough Greensnakes found along forest edges near roadsides and Smooth Greensnakes in open fields with sparse vegetation. Only *Opheodrys aestivus* adults were found, while *Opheodrys vernalis* was represented by age groups from hatchlings to older adults. The data might suggest that differences in both activity period and habitat preference may explain differences in population structure.

- P46B STEELMAN, CHARLOTTE K. AND MICHAEL E. DORCAS. Davidson College—The effects of environmental variation and anthropogenic noise on calling activity of Anurans.

Documentation of declines in amphibian populations has been both dramatic and alarming. Most of these declines have been documented in anuran populations and various factors have been implied as causes for these declines. Because anurans rely on acoustic communication for reproductive activity, it is important to understand factors, both natural and anthropogenic, that may affect calling. In an effort to understand the environmental and anthropogenic variants affecting anuran-calling activity, we measured anuran-calling activity at two ephemeral wetlands using manual calling surveys and automated recording systems. We describe the effects of environmental variation and anthropogenic noise, such as airplane traffic, on the calling activity of *Pseudacris crucifer*, *Pseudacris feriarum*, *Rana sphenoccephala*, *Rana palustris*, and *Acris crepitans*. Based on the results of this study, we predict the best conditions for sampling these species using manual calling surveys. Furthermore, we develop an understanding of the effects of ambient noise on anuran calling and how that noise might affect anuran reproductive fitness.

Plant Biology

- P47 LUMAGA, MARIA ROSARIA BARONE¹, JAMES E. MICKLE², ALDO MORETTI¹ AND PAOLO DE LUCA¹. Università degli Studi di Napoli "Federico II"¹, North Carolina State University²—SEM studies of cuticle micromorphology in *Cycas* L. (Cycadaceae).

Whole leaf and isolated cuticle specimens from *Cycas* L. were examined using SEM for features of inner and external surfaces and three-dimensional structure of the stomatal complex, characteristics useful in taxonomic determination. Samples were collected from the midregion of leaflets from the midregion of mature leaves of greenhouse-grown *Cycas revoluta* Thunb., *C. rumphii* Miquel, *C. circinalis* L., *C. media* R. Brown and *C. normanbyana* Muell. For external surfaces, samples were air dried or fixed in FAA (10:5:50). For the inner cuticle surface, cuticles were isolated using 20% Cr₂O₃. Characteristics in common to these species include hypostomy, hair bases on abaxial and adaxial surfaces, adaxial cells randomly arranged, adaxial exterior cuticle smooth, and stomatal pit always formed by two layers of epidermal cells. Stomatal complexes polyperigenous, randomly dispersed and oriented and, except in *C. revoluta*, not contiguous. Stomata are deeply sunken in *C. revoluta*, intermediate in *C. rumphii* and *C. normanbyana*, and less sunken in *C. circinalis* and *C. media*. Aperture between guard cells extends the entire length of the stomatal complex in *C. rumphii* and *C. normanbyana*, about 80% in *C. circinalis* and *C. media*, and about 50% in *C. revoluta*. Based on cuticular features, *C. revoluta* shows the greatest number of differences from the other species, *C. media* and *C. circinalis* show the most similarity to each other and *C. normanbyana* and *C. rumphii* show the most similarity to each other. This contrasts with current taxonomy which places *C. normanbyana* in synonymy with *C. media*.

- P48 COLLIER, MATTHEW H.¹, BRIAN KEANE² AND STEVEN H. ROGSTAD³. Wittenberg University¹, Miami University, Hamilton² and University of Cincinnati³—Productivity differences between dandelions (*Taraxacum officinale*; Asteraceae) taken from pollution impacted versus non-impacted soils.

Common dandelions (*Taraxacum officinale* Weber) introduced to North America form an assemblage of asexual (agamospermous), clonal lineages derived from Eurasian mixed sexual and asexual populations. We investigated the hypothesis that productivity differs between pollution tolerant and intolerant dandelion clones when grown in both polluted and unpolluted environments. We tested the above hypothesis by performing reciprocal greenhouse planting experiments in which unique dandelion clones sampled from two unpolluted and two polluted sites were grown pairwise in both unpolluted and polluted media. Dandelion clones taken from polluted sites were shown to produce fewer and smaller leaves, shorter roots and smaller root diameters, reduced shoot and root dry weights, and reduced total biomass when grown in unpolluted-media with clones taken from unpolluted sites (all statistical tests, $P \leq 0.05$). Alternatively, clones taken from unpolluted sites were shown to produce significantly fewer and shorter leaves, shorter roots and smaller root diameters, reduced shoot and root dry weights, reduced total biomass, a reduced shoot:root biomass ratio, and have much lower survival when grown in polluted-media with clones taken from polluted sites (all statistical tests, $P \leq 0.05$). These results reveal that productivity differences exist in unpolluted-site clonal lineages grown in polluted-media and in polluted-site clonal lineages grown in unpolluted-media. This study has also shown that relative fitness of dandelion clones varies in response to pollution, and suggests that there are costs to being either non-pollution or pollution tolerant relative to fitness in the contrasting alternative environments.

- P49 GRANT, STEPHANIE AND LAURA E. DEWALD. Western Carolina University—The effects of the decline of the *Castanea dentata* and different management techniques on the genetic diversity of *Quercus rubra* in Western North Carolina.

Quercus rubra is an important species in the southern Appalachian ecosystem. However, efforts to facilitate regeneration in western North Carolina have met with limited success and the subsequent population decline may be resulting in loss of genetic diversity in this species. This study used nine microsatellite markers to determine if *Quercus rubra* populations located in western North Carolina have experienced a change in genetic diversity following: 1) the disappearance of *Castanea dentata* and 2) changes in forest management. Cambial samples were taken from 250 individuals located in four managed and four preserved sites in the Nantahala National Forest. The sites used in this study were historically dominated by *Castanea dentata* and each managed site was located within a mile of a preserved site of similar forest type. The hypotheses tested by this study were: 1) genetic diversity of *Q. rubra* trees established pre- and post-blight does not differ, 2) genetic diversity of *Q. rubra* populations before and after tree removal does not differ. Relative genetic diversity will be described in terms of allele frequencies, observed and expected heterozygosities, effective number of alleles, and fixation index. Genetic variation will be analyzed using ANOVA, and autocorrelation analysis.

- P50 REFI, SARAH S. University of South Carolina-Columbia—The COP9 signalosome subunit LeCSN5 controls defense responses to wound and pathogen signals via interaction with MAP kinase pathways.

We study how tomato plants (*Lycopersicon esculentum*) defend themselves against insect herbivory by initiating a systemin-mediated signal transduction pathway that leads to increased levels of defense proteins. Of particular interest is a mitogen-activated protein kinase (MAPK) cascade that has an important function in the systemin-mediated wound response pathway. It has been previously shown that this same MAPK cascade is also activated in the microbial pathogen response pathway; however, the activation kinetics of the MAPK cascade differs between these two responses. It is yet unclear how both pathways could utilize the same signaling components and still have very different responses. We utilized a yeast two-hybrid screen in order to identify proteins that interacted with a component of the MAPK cascade, LeMKK4. One protein identified in the screen is the tomato homolog of JAB/CSN5, an essential subunit of the COP9 Signalosome Complex (CSN). We then silenced the expression of this protein in wild-type and 35S::Prosystemin Micro-Tom tomato plants using virus-induced gene silencing, which causes transcriptional silencing of the endogenous JAB/CSN5 transcript. These plants showed reduced levels of wound-responsive genes and increased levels of pathogen-responsive genes, as well as higher basal activity of the MAP kinases LeMAPK1/2. Based on what is known about the cross-talk between the wound and pathogen response pathways, and our initial findings, we hypothesize that JAB/CSN5 functions via proteasome-mediated proteolysis to regulate the activation kinetics of the MAPK cascade and can therefore act as a switch between wound response and pathogen response.

- P51 PANCHOLI, SUCHITA AND JOHANNES STRATMANN. University of South Carolina-Columbia—Activation of MAPKs and direct defense responses in *Lycopersicon esculentum*.

Plants have developed defense mechanisms to protect themselves from biotic stresses including feeding by herbivorous insects. Insect attack induces direct and indirect defense responses by the plant. For direct defense, the plant synthesizes secondary metabolites and proteinase inhibitors that inhibit the ability of the insect to digest the leaf proteins. For indirect defense, the injured plant releases volatiles into the air to attract parasitoid wasps to lay eggs inside the feeding insect. One well-studied pathway in tomato (*Lycopersicon*

esculentum) is the systemin-mediated signal transduction pathway, which includes the activation of a mitogen-activated protein kinase (MAPK) cascade. Mechanical wounding by a hemostat and insect feeding by tobacco hornworms (*Manduca sexta*) have been shown to induce MAPK activation and proteinase inhibitor synthesis in tomato. Previous results have shown that LeMPKs 1 and 2 are activated in the wounded leaf in response to insect attack, while LeMPK 3 is activated only in the systemic leaf in response to insect feeding. Oral secretions of beet armyworms and tobacco hornworms have been found to contain fatty acid amino acid conjugates (FACs), which act as inducers for the volatile release. However, it is unknown whether the FACs of the oral secretions induce direct defense responses via MAPK activation. We have found that *Lycopersicon peruvianum* suspension-cultured cells are responsive to the oral secretions. The usage of alkalization response assays, kinase assays, and radial immunodiffusion assays will clarify whether the application of oral secretions to artificial wound sites on the plant induce defense responses.

P52 **CANCELED**

- P53 LLOYD, MICHAEL W. AND ROLAND P. ROBERTS. Towson University—Phylogenetic position of three morphologically distinct North American populations of *Arabidopsis lyrata* spp. *lyrata* among species of *Arabidopsis* and related genera.

This study investigated the phylogenetic position of *Arabidopsis lyrata* spp. *lyrata* from three morphologically distinct populations. We used nuclear ribosomal DNA (ITS) to assess the position of *A. lyrata* spp. *lyrata* from all three populations among other species of *Arabidopsis*. Previous studies of the Brassicaceae failed to include samples of this widely distributed North American taxon. Morphological distinctiveness among *A. lyrata* spp. *lyrata* appears to be linked to locality. As a result, it was necessary to verify the identity and relationships of individuals from these populations in preparation for a comprehensive study of population structure and gene flow. We used the ITS data set of O'Kane and Al-Shehbaz and added data from six populations representing three distinct substrate types. Bayesian and Parsimony analysis indicate that *A. lyrata* spp. *lyrata* clusters with other subspecies of *Arabidopsis lyrata*. However ITS data does not provide enough variation to resolve relationships within the lineage. More informative gene regions are needed to resolve fine scale relationships among species and subspecies of *Arabidopsis*.

- P54 MASSEY, F. WANDA AND ROLAND P. ROBERTS. Towson University—An assessment of gene flow among populations of *Solidago sempervirens* along the eastern and western shores of the Chesapeake Bay.

Microsatellite data were used to detect genetic similarities among populations of seaside goldenrod (*Solidago sempervirens* L.) growing on the western and eastern shores of the Chesapeake Bay in Maryland. Goldenrods are insect-pollinated plants that are frequent in habitats along the Chesapeake Bay and Atlantic coast of Maryland. Comparison of microsatellite variation among populations along the shores of the Chesapeake Bay has the potential to assist in identifying gene flow and the extent of population substructure for this species. Similarity in microsatellite composition might be indicative of the range of pollinators of this species along and across the Bay. Alternatively, such signal might be residual from a previously more homogeneous less fragmented distribution of this species. Preliminary investigations using microsatellite primers developed by Wieczorek and Geber resulted in successful amplification in all populations sampled on the western shore. Analysis of data from 23 individuals representing three localities along the western shore revealed fourteen alleles. These alleles are distributed across three loci with several common across localities. This preliminary data set is also characterized by a large

number of heterozygous individuals. We will continue sampling along the western and eastern shores of the Bay to amass a larger data set on which more rigorous conclusions can be based.

P55 WOODS, MICHAEL. Troy University—The genus *Lespedeza* (Fabaceae) in Alabama.

Lespedeza Michaux is a member of the legume family Fabaceae (Leguminosae), subfamily Papilionoideae, tribe Desmodieae. *Lespedeza* consists of approximately 40 species in eastern Asian and eastern North America. Eighteen species, one infraspecific taxon and 34 hybrids of *Lespedeza* have been reported from the United States. Of these, 13 species, one infraspecific taxon and 24 hybrids have been reported from the southeastern United States. Based on the results of this study, eleven species, one variety, and 13 hybrids of *Lespedeza* are recognized as occurring in Alabama. Three of these ten species, *L. bicolor* Turcz., *L. cuneata* (Dum.-Cours.) G. Don and *L. thunbergii* (DC.) Nakai are introduced and have become established throughout the state. The dichotomous keys and descriptions are modifications from earlier authors; however, all measurements are based on morphological features of the vegetative and reproductive structures of the plants studied during the project. Data for the distribution maps was gathered from personal collections and plant specimens deposited in the herbaria of Troy University (TROY), Auburn University (AUA), The University of Alabama (UNA), The University of South Alabama (USAM), Jacksonville State University (JSU), University of North Alabama (UNAF), University of West Florida (UWFP), Florida State University (FSU), and Vanderbilt University (VDB), which is housed at the Botanical Institute of Texas (BRIT) in Fort Worth. Support for this project was provided through a Research Grant from the Troy University Faculty Development Committee.

P56 CANCELED

P57 STEWART, HEATHER, CAROLJANE ROBERSON AND JOE POLLARD. Furman University—Manganese hyperaccumulation in *Phytolacca americana*.

Hyperaccumulation of metallic elements to exceptional concentrations in plant tissues is a rare phenomenon, reported for nine elements and approximately 450 plant species. Most known cases involve species that are restricted to metal-enriched soils. Researchers in China recently found that *Phytolacca acinosa* growing on manganese-polluted soils can hyperaccumulate manganese, and further showed that plants from normal soils also possess the ability to hyperaccumulate this element. Because the genus *Phytolacca* is taxonomically small, we chose to investigate whether ability to hyperaccumulate manganese might exist in another species, not known to occur on manganese-enriched sites at all. *Phytolacca americana* (pokeweed) is a ubiquitous weed of roadsides and disturbed areas in the southeastern USA. Field-collected samples from Greenville, SC contained approximately 2000 µg/g Mn on a dry-weight basis, while other species from the same site ranged from 50 to 450 µg/g. Seedlings of *P. americana* were transplanted to the laboratory and grown hydroponically in nutrient solutions ranging from 15 µM to 8 mM Mn. After three weeks in the most concentrated Mn solution, the average Mn concentration in leaves was over 32,000 µg/g or 3.2%. This clearly qualifies *P. americana* as a hyperaccumulator of manganese. We believe that this is the first case where latent physiological ability to hyperaccumulate a metal has been discovered in a species not known to associate with that metal in nature. Future studies will attempt to find populations of *P. americana* on Mn-enriched soils, to determine whether the property is ever expressed in the field.

- P57B HUYLER, ANN¹, HOWARD S. NEUFELD¹ AND KENT O. BURKEY². Appalachian State University¹ and USDA-ARS Plant Science Research Unit²—The effects of acute or chronic ozone exposure on the antioxidant content of tulip poplar, *Liriodendron tulipifera*.

Tulip poplar, *Liriodendron tulipifera*, is a fast growing, prolific canopy tree that is reputedly ozone sensitive with respect to foliar injury, but insensitive with respect to growth effects. These conflicting responses suggest that perhaps the failure of the foliar injury to translate into growth reductions could result from efficient anti-oxidant responses in the leaves. To investigate this defense mechanism, we studied components of antioxidant metabolism in tulip poplar saplings exposed either to chronic (65 ppb) or acute (200 ppb) ozone concentrations. Two year old potted saplings were grown outdoors and then exposed to acute (SUM00; 2400 ppb*hr, in one day) and chronic (SUM00; 2340 ppb*hr over three days) levels of ozone. The total content and redox value of ascorbic acid and glutathione and the activity levels of guaiacol peroxidase were analyzed days s, and for the s directly following the end of the exposure treatments. Stomatal conductance was measured four times a day and chlorophyll fluorescence twice a day throughout the experiment. On the acclimation days and the two post-exposure days, leaf samples were stained with 3, 3'-diaminobenzidine (DAB) and nitroblue tetrazolium (NBT) to determine the stress related presence of hydrogen peroxide and superoxide anion, respectively. Acute ozone exposure triggered stipple formation on the older leaves, but not consistently. The DAB staining revealed the presence of hydrogen peroxide with leaf samples showing stipple while the NBT staining was inconclusive. Currently we are analyzing the physiological and biochemical data and the findings will be discussed.

Aquatic, Wetland and Marine Management

- P58 BLAIR, BENJIE¹, LAWRENCE NELSON¹, CHRIS MURDOCK¹, MARK MEADE¹, STEPHEN WATTS², AND ADDISON LAWRENCE³. Jacksonville State University¹, University of Alabama in Birmingham² and Texas A&M University³—Qualitative analysis of sea urchin, *Lytechinus variegates*, gut microflora to improve culture methods.

In the US farming of sea urchins has become an economic feasibility. In the mid 1990's sea urchin exports totaled \$174 million, yet in 2001 this dropped to \$80 million. While demand placed pressure on fisheries around the costal United States, sea urchins have experienced population declines of up to 90%. This has been the impetus for an increase in development of culture methods for captive sea urchins. However, some desirable characteristics of the roe or uni are lost in captive culture. Sea urchins have a unique digestive system, their "stomach" lacks certain digestive enzymes, and yet they are able to digest high percentages of food biomass consumed. Upon ingestion of a food item, it is ground and formed into a pellet and encased with in a mucus membrane which remains the same size through the entire digestive track. It is hypothesized that this highly efficient digestion is due to the cooperative action of bacteria. This study is the first to use 16s rDNA sequence analysis to determine the total bacterial inhabitants in captive-raised sea urchins. Sequences from a clonal library were analyzed using the NCBI Blast search engine. From the sequence data it was noted that the captive-raised sea urchins contained a limited number of representative genera. The genera commonly represented included primarily *Pseudomonas*, and *Vibrio* and epsilon proteobacterium species.

- P59 TURNER, JOSHUA, MARK MEADE AND GREG SCULL. Jacksonville State University—Genetic dynamics of fish populations in the Middle Coosa Watershed, Alabama.

Alabama's diverse geologic features have created abundant and variable aquatic habitats that support one of the richest aquatic faunas in the world. The Mobile River Basin is a rich ecosystem containing over 180 endemic freshwater species. The Coosa Watershed is the most biodiverse subwatershed of the Mobile River Basin in terms of fish species. Conservation of these species is of great concern since much of the aquatic fauna is in peril due to land use changes within the basin. Urban development and the construction of reservoirs are threatening the once free-flowing natural streams and rivers that provide habitat to freshwater species. In recent years, DNA-based studies have been a major interest in gathering data for conservation biology and population genetics for species in peril. There is limited information on genetic diversity of fish populations within this region and recent efforts have begun to examine genetic diversity of populations using allozyme electrophoresis. Allozyme analysis is a preferred approach to population genetics because it assays many nuclear loci rapidly and inexpensively. Our goal is to describe the genetic structure of fish populations within the Middle Coosa Watershed using allozyme analysis.

- P60 AGRAZ, VICTOR A. Western Carolina University—The effect of hydrology and disturbance on the growth of *Juncus effusus* L. in a restored southern Appalachian wetland.

Some wetland plants thrive in flood conditions and contribute large amounts of organic matter to freshwater wetland ecosystems. *Juncus effusus* is a common wetland plant known to tolerate a wide range of soil saturation levels and environmental conditions. The purpose of my study was to determine the effect of different seasonal and annual water table levels (i.e. hydroperiod) on the annual net above-ground primary production of *J. effusus* in a restored wetland. The areas chosen for this study were wet and dry plots located within disturbed and undisturbed areas of the wetland. Annual net aboveground primary production was estimated by subtracting the harvested dry weight (i.e. biomass) of 2004 from the harvested dry weight of 2003. Using historical as well as recent (summer 2003 – summer 2004) data from groundwater wells, I predicted the sites with higher and more stable annual water table depths would correlate with higher productivity in *J. effusus*. Hydrology was an inconsistent explanatory variable for *J. effusus* biomass. A multiple regression showed that only the second wettest plot (undisturbed wet) explained ($p < 0.05$) biomass of *J. effusus*. However, light explains *J. effusus* biomass if $0.05 < p < 0.10$ is accepted. There is an open canopy at each plot so decreased light levels within each plot were attributed to other species, most notably shrubs. These species are strong competitors and may explain *J. effusus* annual growth better than hydrology.

- P61 STOECKMANN, ANN M. AND ASHLEY BREWINGTON. Francis Marion University—Seasonal patterns of water quality parameters and their contribution to low dissolved oxygen in a SC blackwater creek.

Jeffries Creek, a slow moving blackwater creek (Florence County, SC) is on SCDHEC's *List of Impaired Waters* due to low dissolved oxygen (DO). DO is influenced by temperature, depth, flow, and organismal oxygen demand. Drainage into blackwater creeks often comes from swamps and floodplains, areas with high organic matter that depletes DO in the drainage water and may be added to the creek. Organic matter increases bacteria growth which, because of their respiratory processes, decreases DO. The combination of these factors can lead to high oxygen demand and low DO. We have been measuring DO, temperature, and depth every 2-4 weeks at 6 locations along Jeffries Creek since August 2005. We added water clarity, pH, and conductivity in June 2006. Preliminary results show low DO ($< 3\text{mg/l}$) at 3 of 6 locations beginning in June with very low levels continuing at two locations until early November. Dissolved oxygen at all locations began to increase by late November when water temperatures decline. To investigate local factors influencing DO at one site with consistently low DO, we measured organic content of the seston and BOD (biochemical oxygen demand) beginning in June

2006. Preliminary results showed DO was positively correlated to water clarity and depth while BOD was positively correlated to organic content of the seston. In addition, on particular dates when DO and water clarity were low, BOD and seston organic content were high indicating that high organic content at this site likely responsible for low DO.

- P62 LEE, REBEKAH AND JANET MACFALL. Elon University—Enzyme activity in hyporheic soils of piedmont Streams.

Enzyme activity in hyporheic soils of Piedmont streams was studied in central North Carolina. The hyporheic zone is an ecotone where the stream water and ground water meet. The enzymes studied include Protease, Phenol Oxidase, and Nitrate Reductase which were chosen for their importance in nutrient cycling. Soils from two eroded sites, two non eroded sites, and a restored site with both a restored and eroded section were sampled. Each site was sampled twice with three samples collected at each site per visit with the exception of the restored site from which two samples at each section were taken each time. Soils were taken to the lab and tested for enzyme activity using standard techniques. Enzyme activity was similar between samples taken at the same site. Nitrate Reductase and Phenol Oxidase activity are not different between sites. Protease activity is higher in activity in non eroded sites than in eroded sites. The goal is to identify target characteristics of soils in healthy piedmont streams.

- P63 STONE, PETER A.¹, MICHAEL J. DUEVER² AND JOHN F. MEEDER³. South Carolina Department of Health and Environmental Control¹, South Florida Water Management District², and Florida International University³—Origin and evolution of Corkscrew Swamp Sanctuary, a freshwater peatland in southwest Florida.

Corkscrew Swamp, a treasured preserve, contains mature cypress swamp with a marsh interior area (recently succeeded to willow) within a basin in ancient marine sediments. Its natural development is evidenced in the oldest continuous wetland sedimentary record known for South Florida. The present peatland overlies freshwater marl (carbonate mud) and in South Florida marl precipitates in sparsely vegetated seasonal marshes, not in lakes. Marlland, apparently from wet-prairie, long preceded the present peatland's dense marsh and swamp. Peat now forms in longer-flooded denser marshes. This formerly dry sandy basin got significantly wetter (presumably rainier) around 10,600 BP (standard radiocarbon years) when the marl stage began and wetter still, despite partial infilling by marl, around 5500-4500 BP as the present peatland initiated and spread. Thick peat derived from shallow marsh shows that average water elevation (not necessarily depth) rose as peat partially filled the basin. Similar inference exists for other SEUS wetlands with thick peat: water rose. Pollen stratigraphy at a marsh location suggests some reversing minor stage in middle parts of the peatland era. This may relate to (1) climate-driven changes shown in the nearby Everglades centered around 2500 BP, or more likely (2) secondary succession after severe disturbance, probably deep peat fire. A shift from swamp to marsh in that same area might reflect the latter. A deeper area of different swamp vegetation (popash) within the cypress forest shows a buried woody charcoal layer lying beneath peat dated at ca. 500 BP, evidencing a long-lasting influence of severe natural disturbance.

- P64 SPARKS, MELINDA¹, HERMAN W. HUDSON¹, ROBERT B. ATKINSON¹ AND JAMES E. PERRY, III². Christopher Newport University¹ and College of William and Mary Virginia Institute of Marine Science²—The effect of *Typha glauca* and hydrology on *Taxodium distichum* saplings in a three-year-old created forested wetland in southeastern Virginia.

Permits to destroy wetlands often require monitoring to ensure compliance with permit conditions such as survivorship of planted vegetation and absence of invasive species.

Cattails, *Typha* spp., frequently invade created wetland sites and are thought to outcompete planted trees, which has led to cattail elimination by herbicidal treatments or regrading. This study was initiated to determine the effect of cattails, *Typha glauca*, on growth of planted bald cypress, *Taxodium distichum*. The study was conducted in a three-year-old 5.02-ha created wetland site located in Suffolk, VA that was planted with bald cypress and invaded by cattails. Stem density and cover of cattails, water depth, and four tree morphological characteristics were measured in plots containing 91 randomly selected trees. Normality was tested and Pearson Correlations (PC) were used to detect significance. Growth of bald cypress was not affected by cattails presence or abundance ($p > 0.1$); however, growth characteristics of bald cypress were negatively affected by water depth, including mean tree height (PC = -0.32, $p = 0.002$), mean canopy diameter (PC = -0.24, $p = 0.02$), and to a lesser extent, mean tree dbh (PC = -0.20, $p = 0.057$) and tree diameter at ground level (PC = -0.19, $p = 0.07$). These results suggest that cattail elimination at mitigation sites may not increase growth of bald cypress. Further research is planned in order to assess the effect of cattails on bald cypress survival and to confirm these findings at additional sites.

- P65 OGBURN, DAMON AND LINDA NIEDZIELA. Elon University—The effects of oil dispersants on mortality, development, and ATPase activity in *Artemia franciscana*.

Crude oil spills in aquatic environments are ameliorated using dispersants. Surfactant-based dispersants, while safer than earlier formulations, have the potential to increase mortality and disrupt cell membrane integrity of aquatic organisms. Brine shrimp (*Artemia franciscana*) are aquatic crustaceans used as test models for environmental toxicity. They were used to assess the effects of two oil dispersants on mortality, development, and ATPase activity. Mortality studies were performed on pooled samples of 50 shrimp treated with a concentration range of 0 - 10,000 ppb with Dispersit SPC-1000™ and 0 - 1,000 ppm with Sea-Brat™. Results of these studies determined sub-lethal treatment ranges of 500 - 10,000 ppb (Dispersit™) and 10 - 1,000 ppm (Sea-Brat™) for developmental assays. Using a micrometer, 25 randomly chosen shrimp were measured at 100X magnification after 24 and 48 hour treatments with both dispersants. Neither dispersant caused significant differences in developmental rate or success. ATPases are membrane-bound enzymes involved in the transport of electrolytes across the membranes of marine organisms and can be affected by a variety of contaminants. Mg^{++} and Na^+/K^+ ATPase activities were measured using the EnzChek® Phosphate Assay following 24 and 48 hr treatments. Results showed that Sea-Brat™ altered Na^+/K^+ ATPase activity and may suggest that the enzyme was struggling to maintain osmotic balance across the plasma membrane. While oil dispersants lessen negative effects of crude oil, this study illustrates that dispersants themselves carry risks and should be used carefully.

- P66 CINCOTTA, DAN A.¹ AND STUART A. WELSH². West Virginia Division of Natural Resources¹ and U.S. Geological Survey²—Fishes of West Virginia: an atlas of West Virginia fish.

During the past five years, we have synthesized and compiled data on historic and recent fish collections in West Virginia into a georeferenced database. The West Virginia fish database will be used to produce a spatial and temporal atlas of fish distributions, and currently includes over 8,000 site records from fish collections during 1853 to 2005. Species distribution data will be depicted by time periods which reflect the substantial contributions and efforts of Ebenezer Andrews, Spencer Baird, Charles Bollman, William Hay, E.L. Goldsborough, Carl and Laura Hubbs, Milton Trautman, A.H. Wright, John Addair, Ed Raney, L.W. Wilson, E.A. Seaman, P.E. Swasey, H. Van Meter, Anthony Bodola, Frank Schwartz, Ron Preston, Bob Denoncourt, Charles Hocutt, Jay Stauffer, Rich Raesly, West Virginia Division of Natural Resources personnel, as well as collections

from the authors. Over 2000 of the 8,000 site records are represented at museums, and we have verified species identifications of most of the individual lots of these records at Cornell University, University of Michigan Museum of Zoology, American Museum of Natural History, North Carolina State Museum, United States National Museum, and Ohio State University Museum. Additionally, we will include dichotomous keys (with illustrations) for identification of families, genera, and species. The general format, highlights, and illustrations of this upcoming book are presented.

FRIDAY, APRIL 20, 2007

Plant Ecology

- P67 LU, ZHIJUN AND SCOTT FRANKLIN. Department of Biology, University of Memphis—Clonal integration and expansion of bamboo (*Bashania fargesii*) into old-fields.

Connected ramets can share resources through stolons or rhizomes via physiological integration. *Bashania fargesii* is one of the pioneer species invading old-fields in Foping Natural Reserve, Qingling Mountains, China. We used 0.5% acid fuchsin as dying material to detect the integration of *B. fargesii* and its expansion into old-fields. We set up a dying treatment at 15 sites including 12 from bamboo forest to old-fields and three from old-field to bamboo forest. We recorded the coordinates of the connected ramets and their basal diameter, height, total number of leaves and number of leaves died by acid fuchsin. Then, we harvested the died ramets and weighed their dry biomass. We found that: 1) connected bamboo ramets shared resources (water and nutrient) via rhizomes, i.e. clonal integration existed in *Bashania fargesii*, 2) the furthest clonal integration we detected was 3.84 m, and 3) resources could be transported proximally and distally.

- P68 MEEKS¹, LISA, CASANDRA REYES², JOSE LUIS ANDRADE², JOSE CARLOS CERVERA², THOMAS MCELROY¹ AND PAULA C. JACKSON¹. Kennesaw State University¹, Centro De Investigación Científica De Yucatán²—Preliminary study of the physiology of three tree species in Dzibilchaltun, Yucatan Peninsula, Mexico.

This study was conducted in the dry deciduous forest of Dzibilchaltun, Yucatan, Mexico. The arid climate of this type of forest requires a variety of adaptive physiological responses by trees, the extent of which has yet to be thoroughly understood. The objective of this study was to collect physiological data for three tree species that differ in their leaf flushing pattern and dominate the dry forest of Dzibilchaltun. The species studied were *Gymnopodium floribundum*, *Diospyros cuneata* (both evergreen), and *Piscidia piscipula* (a brevi-deciduous species). The study took place at the height of the dry season, May 2006. Data were collected for one leaf per individual and three individuals per species using a Heinz-Walz GmbH MINI-PAM Photosynthesis Yield Analyzer. Pre-dawn and midday water potentials were collected using a Scholander-type pressure chamber. Light saturation curves indicate that *P. piscipula* (brevi-deciduous) maintained higher average apparent electron transport rates, light saturation points and water potentials, and a lower average NPQ (heat dissipation) value as compared to the evergreen species (*D. cuneata* and *G. floribundum*). Comparisons of *D. cuneata* and *G. floribundum* (evergreen) revealed that *D. cuneata* maintained a lower average electron transport rate, light saturation point, and NPQ; and a higher average water potential as compared to *G. floribundum*. We found high variability in apparent electron transport rate between individuals of *G. floribundum*, and all water potential measurements for this species were beyond the scale of the pressure chamber. Our data suggest potential differences in the physiological response to drought of these three species.

- P69 ROSE, SAMUEL AND JONATHAN HORTON. University of North Carolina at Asheville—Mycorrhizal influence on photosynthesis and biomass production in drought-stressed *Celastrus orbiculatus*.

Influence on growth or seed viability by vesicular-arbuscular mycorrhizae (VAM) has been observed in association with many plants in different environments, usually in an enhancing role. Greater uptake efficiency for water and phosphorus has been demonstrated in temperate and tropical systems. *Celastrus orbiculatus* (Asiatic Bittersweet) is a native to Asia that was introduced into North America in the 1870's and was cultivated as an ornamental vine in no less than 33 American States. It naturalized quickly and now it has taken over in many primary successional areas where it outcompetes many native species, including *Toxicodendron radicans* and *Celastrus scandens*. In the past decade the expansion of *C. orbiculatus* has reached epidemic proportions, particularly in the southern Appalachian region, where *C. scandens* populations are now non-existent with the exception of small, isolated areas where there is no competition from *C. orbiculatus*. This study focuses on the ability of VAM's to ameliorate drought stress in *C. orbiculatus*. We established a 2x2 factorial design with high water/low water and mycorrhizal inoculant/fungicide treatments in a greenhouse. We monitored soil water content, leaf gas exchange and plant water potential of these groups for 4 months. As expected, plant water potential was higher in the high water treatment on several dates and was occasionally higher in the mycorrhizal treatment. Surprisingly, early in the study photosynthetic rates were larger in the fungicide treatment than the mycorrhizal treatment. Our results suggest that VAM may not be important to maintaining water status in *C. orbiculatus*.

- P70 WAIER, JACLYN AND PAULA C. JACKSON. Kennesaw State University—A First Look at the Physiology of *Cypripedium acaule* (pink lady's slipper) compared to two other understory plants: *Asarum canadense* (wild ginger), and *Quercus sp.* (oak sapling).

Pink lady's slippers are rare orchids, which bloom 10 – 20 times in their ~100 year lifespan. Few studies have looked at the physiology of this species across a growing season. This study took place in the understory of a mixed hardwood-pine woodland on the Kennesaw State University campus from mid-April through late-June 2006. Diurnal and seasonal changes in maximum photosynthetic rates and light saturation points (measured using a LiCOR 6400 gas exchange system) of the pink lady's slipper were examined. Late in the season, the values obtained for the lady slipper were compared to wild ginger (*Asarum canadense*) and an oak sapling (*Quercus sp.*). Data indicated diurnal and seasonal differences in maximum photosynthetic rates and light saturation points for the pink lady's slipper; with the highest light saturation point and photosynthetic rate found early in the season, and then progressively declining. Measurements for wild ginger and the oak sapling were taken in late-May and June. Compared to these species on the same day, the pink lady's slipper had the lowest maximum photosynthetic rates followed in increasing order by the wild ginger, and the oak, which had the highest rates (pink lady: 1.5; wild ginger: 4.0; oak: 4.4, $\mu\text{molm}^{-2}\text{s}^{-1}$). However, when maximum photosynthetic rates were compared across season (independent of date or time of day), all species had similar maximum rates (oak: 4.43, pink lady: 4.36, wild ginger: 4.02, $\mu\text{molm}^{-2}\text{s}^{-1}$). To manage the pink lady's slipper populations effectively further understanding of its physiology is necessary.

- P71 WARREN, ROBERT J., II AND H. R. PULLIAM. University of Georgia—Demographic response of two understory evergreen herbs across multiple environmental gradients.

Despite many studies demonstrating spatial and temporal variability in the growth, survival and reproduction of plants, few field studies have linked demography directly to spatial or temporal gradients in physical variables. I looked at presence, abundance, survival and fecundity in two evergreen herbaceous species (*Hexastylis arifolia* and *Hepatica nobilis*) as measured in a five-year field demography experiment by the H.R. Pulliam lab. The objectives of this research are to examine (1) if abiotic variables such as light availability and soil moisture can explain the demographic performance of two understory evergreen herbaceous species—*Hepatica nobilis* and *Hexastylis arifolia*—and (2) determine if the two plants exhibit different demographic responses to those variables. The plants were monitored in demographic grids located in the northern Piedmont of Georgia. Each study grid was divided into 2 x 2 m grid cells and all individuals were located, marked and measured each year since spring 2000. Physical monitoring was done in cells uniformly distributed within each grid. Regression models indicated that maximum plant abundance and performance was at intermediate resource levels rather than at the highest ends of the environmental gradient; and *H. nobilis* and *H. arifolia* exhibited distinct responses to the environmental variables, suggesting unique abiotic niches.

- P72 ALLEN, CARRIE E. AND CHRISTOPHER A. ADAMS. Shorter College—Seed dormancy and germination ecology of dimorphic seeds in *Grindelia lanceolata* (Asteraceae) from cedar glades in North Alabama.

The purpose of this study was to determine if there are significant differences in the germination ecology of *Grindelia lanceolata* seeds from populations in central Tennessee vs. seeds from populations in northern Alabama. Baskin and Baskin (1979) determined that disc achenes germinated over a wider range of temperatures than ray achenes. Also, a cold stratification period widened the temperature range for germination for both types of seeds, indicating that some seeds in a population have physiological dormancy. In a study on the growth phenology of *G. lanceolata* plants from TN and plants from AL, Adams, Baskin, and Baskin (2003) determined that there are significant differences in flowering phenology, morphological characteristics, and general life cycle type between the two groups. This indicates that there most likely are genetic differences between the two plant groups suggesting that they may be extant populations of different races. The purpose of this study was to determine if there are significant differences in seed dormancy and germination characteristics between *G. lanceolata* plants from central TN and northern AL. Seeds of *G. lanceolata* were obtained from populations on cedar glades in north Alabama. Ray and disc achenes were separated, and each group subjected to different periods of cold stratification (2, 4, 6, and 8 weeks) at 5°C and then moved to 25°C. Germination percentages were recorded for each group. Also, disc and ray achenes were cold stratified in darkness at 5°C for 8 weeks and then moved to 25°C in dark. Germination percentages were recorded for these treatments as well. Fifty ray achenes and 50 disk achenes were planted in a non-heated greenhouse in September 2006. The seeds will be observed through March 2007. Germination data is being continuously recorded. The results and conclusions from the germination studies will be presented,

- P73 WALKER, JOHN F.¹, LORETTA C. JOHNSON², NICHOLAS B. SIMPSON², JUSTIN TROWBRIDGE² AND ARI JUMPPONEN². ¹Appalachian State University and ²Kansas State University—Arctic ericoid plants depend on a unique assemblage of fungi for uptake of organic N.

We investigated the diversity and function of fungi isolated from five arctic ericoid tundra plant species. The predominant fungi were *Phialocephala* sp. (212 isolates), *Pezizula* sp. (83), *Ipex* sp. (14), two *Rhizoscyphus* spp. (13), *Mollisia* sp. (10), *Lachnum* sp. (6) and cf. *Leptodontidium* sp. (5) based on molecular characterization of ~390 cultures obtained from surface sterilized roots. These fungi all formed intracellular coils in roots in resynthesis tests with Ericales hosts. Most types were referred to the Helotiales,

ascomycetes typically forming ericoid mycorrhizae. However, several of the isolated genera have not previously been reported from ericoid hosts, and *Rhizoscyphus ericae* was not detected. To test the function of the root/soil fungi, we assessed uptake of ^{15}N by an ericoid plant *Vaccinium vitis-idaea* in intact sections of tundra: organic N uptake was 40% lower when fungal activity was inhibited by fungicides, while uptake of inorganic N was unaffected. The ability of the dominant fungal types to provide ericoid plants with a variety of organic N sources is being investigated currently in petri plate resynthesis systems.

- P74 HUTCHENS, JOHN J., JR., JAMES O. LUKEN, SUNNI D. STEWART AND SCOTT G. TOMKO. Coastal Carolina University—Prey composition of the Venus' fly trap in a coastal South Carolina landscape.

Although biology of the Venus' fly trap (*Dionaea muscipula* Ellis) has received considerable attention, the ecology of this carnivorous plant has been less well studied. We examined composition of prey captured by *Dionaea* in a nature preserve in coastal South Carolina, and estimated rates of capture success. We had two major questions. First, what is the natural diet, and does prey composition vary by petiole size class? Second, does prey capture success vary by petiole size class? Ten populations were sampled in winter (4 February 2006), spring (17 May 2006), and autumn (26 October 2006). Within each population, two plants in each of three petiole size classes were selected haphazardly for prey assessment (total $n = 60$ plants per sampling date). In the winter, half (51.1%) of all traps on selected plants were closed, and half (50.1%) of these closed traps contained prey, which resulted in 25.4% of all available traps containing prey. No significant differences among petiole size classes were found for any measure of trapping success by plants collected in winter. Prey items in winter consisted primarily of soil-dwelling arthropods, with spiders and ants together composing 46.7% of all prey items. Collembolans and soldier beetle larvae (Coleoptera:Cantharidae) each composed 10.5% of prey. No clear differences in prey composition by petiole size class were evident. Our results showed that prey was captured even during winter. However, no flies and few winged insects were captured, presumably because these were not available during the winter.

- P75 HULL, JAMES C. Towson University—Assessment of impact of deer browsing on populations of *Gentianopsis crinita*, a Maryland endangered species.

Fringed gentian (*Gentianopsis crinita* (Frole.) Ma.) is a state-endangered species found on serpentine soils at Soldiers Delight Natural Environment Area, Maryland. Populations have declined drastically in recent years. This study tested the hypothesis that deer browsing contributed to the decline. All populations of *G. crinita* were surveyed in 2004, 2005, and 2006, and the number of plants and incidence of browsing were recorded. Browsing affected 137 of 563 individual plants counted over three years. The proportion of plants browsed was 19.2, 30.1, and 24.6% in each year, respectively. In a subpopulation of 73 surveyed plants, 27.4% of the populations were browsed at first visit and 35.6% were browsed three weeks later. This represents a 17.2% decrease in flower buds and reproductive potential over three weeks. The implications of this browsing intensity to the decline of *G. crinita* are discussed.

- P76 GIUNTA, ANTHONY JR.¹, DANNY J. GUSTAFSON¹, DENNIS DEEMER² AND CRAIG S. ECHT². The Citadel¹ and USDA Forest Service²—Assessing the fine scale spatial genetic structure of *Lindera melissifolia* in North and South Carolina.

Lindera melissifolia (Walt) Blume is an endangered perennial dioecious clonal shrub that occurs in seasonally flooded wetlands located in 1 – 4 counties in eight states (AL, AR, FL, GA, MO, MS, NC, SC). Microsatellite genetic markers were used to estimate the

number of genetic individuals within and among populations in North and South Carolina. All populations showed extensive genotype clones and each population contained essentially unique genetic combinations. The South Carolina site in Beaufort County and both North Carolina sites (Pondberry Bay, Big Pond Bay) were considerably more genetically diverse than all the populations of the Francis Marion National Forest (SC), however even these diverse sites contained less than 18 genetically distinct individuals from the 52-71 randomly sampled stems. Based on the lack of genetic variation and no observed female flowering plants in the South Carolina populations, we recommend a genetic rescue management program that includes bringing in female plants from North Carolina to augment the South Carolina populations and promote sexual reproduction.

P77 KIMMITT, LU ANNE P. AND JAMES C. HULL. Towson University—Reestablishment of *Gentianopsis crinita* at Soldiers Delight Natural Environment Area.

Gentianopsis crinita is a Maryland endangered species found in the serpentine barren grasslands of Soldiers Delight Natural Environment Area, Maryland. It is an herbaceous biennial, blooming in the autumn of its second year. The overall purpose of the project is to replant the seedlings back into their natural habitat in order to reestablish the dwindling populations. The purpose of this project was to examine the efficacy of transplanting *G. crinita* seedlings into their original habitat and to follow the success and mortality of these transplants. Seedlings of *G. crinita* established in a greenhouse were transplanted into the field. Several cohorts of marked seedlings were monitored for transplant success, overwintering survival, and flowering success. Transplant success rates were relatively high (78.7%). Winter mortality was great (67.7%) and the proportion of transplants that reached flowering was moderate (20.4%). The effectiveness of the transplantation project is evaluated along with recommendations for further conservation efforts.

P78 CHHER, LINDA¹ AND LAWRENCE A. WILSON^{1,2}. Emory University¹ and Fernbank Science Center²—Nonnative invasive plant species in urban forests within Piedmont region of the Southeastern USA.

Nonnative invasive plant species have become a major detrimental impact on natural areas throughout the world. Although most invasive plants colonize disturbed sites, there is a group of species which can invade and have major impacts on relatively undisturbed forests. The purpose of this study was to 1) identify the major nonnative species within an urban Piedmont forest, 2) assess their impact on the plant community, 3) identify their primary method of dispersal, 4) experiment with several removal techniques from hand-pulling to mechanical to spot herbicide application, and 5) experiment with the success of utilizing native alternative plant species to re-establish areas where invasive species have been removed. Our data show that many of the most successful/detrimental species are shade ground cover such as English Ivy *Hedera helix* and *Vinca*. Most invasive shrub species have seeds which are bird dispersed. Many of the successful nonnative plants in forests are evergreen and perennial. In order to address this problem successfully, a major educational effort is necessary to make the public aware of the negative impact some of their nonnative landscape plants have on local natural areas. We have conducted tests on ten species on native alternatives and present their success rates under conditions from full sun to full shade.

P79 MARCINKO, SARAH E. AND ALAN S. WEAKLEY. University of North Carolina at Chapel Hill—Status and trends of rare plant species in the Southeastern United States.

The development of conservation policy for rare plant species has largely been based on one-dimensional strategies such as the identification of biodiversity hotspots. Rarely have

studies assessed multiple factors influencing a species' vulnerability to extinction. In this study, we collected data on 328 rare vascular plant species in order to characterize geographic patterns in rare plant diversity and endemism at state and ecoregional scales, major threats, habitat types, phylogenetic diversity, and trends in rare plant research. Most Southeastern rare plants occur in the Coastal Plain physiographic province (~70%) though Southern Florida has the highest rates of endemism among subprovinces. Nearly 50% of rare plants are concentrated in woodland and glade habitats, a third of which occur in dry pinelands alone. The high number of rare species within large families suggests that if the conservation objective is to capture phylogenetic diversity, few species-poor lineages will warrant protection. The greatest threat affecting the persistence of rare species is habitat loss followed by alterations in disturbance regimes. Similarly, high species diversity frequently coincides with areas most affected by habitat loss and degradation. Of the species examined, less than 30% receive federal protection under the Endangered Species Act. A review of the literature indicates that systematics and population dynamics were covered in 24% and 20% of all studies. Interestingly, restoration and management were treated in only a handful of studies. The enormous pressure on natural resources and increasing rates of global change, however, means most conservation will have to take place in human-modified landscapes.

- P80 HELMS, CLINT L. AND CHRISTOPHER A. ADAMS. Shorter College—Competition studies on *Scutellaria montana* (Lamiaceae), a federally endangered species of northwest Georgia.

Scutellaria montana is a federally endangered species essentially restricted to a few counties in northwest Georgia. The purpose of this study was to determine if competitive ability is one of the characteristics contributing to this species' rarity. In June 2005, seeds were collected from a population of plants in northwest Georgia. These seeds were planted on soil in a non-heated greenhouse under three different light regimes: full shade, partial shade, and full sun. Germinated seedlings were allowed to grow until September 2005. At that point, plants were harvested and placed into drying ovens at 50°C for 48 hours. The plants were then removed and separated into roots, shoots, and leaves. The organs were weighed and data recorded. It was determined that the best growth environment (pertaining to light quality) for *S. montana* was partial shade, based on differences in relative biomass allocation. In February 2006, a competition study between *S. montana* and *Ligustrum sinense* was begun. *Ligustrum sinense* was chosen as the competitor based on its known invasiveness and high competitive ability. *Scutellaria montana* was grown with *L. sinense* under partial shade conditions. The type of experiment used was a de Wit replacement series (relative yield, relative yield total, aggressivity values). The experiment was terminated in August 2006, and the plants were harvested. The *S. montana* plants were dried, harvested, and organs weighed as in the previous experiment. The competitive ability of *S. montana* will be assessed based on its relative biomass allocation in response to competition with *L. sinense*.

- P81 HOLLADAY, CORI-ALICE¹, HOWARD S. NEUFELD¹ AND BEVERLY COLLINS². Appalachian State University¹ and Western Carolina University²—Phytoremediation potential of loblolly pine (*Pinus taeda* L.) in wetland soils with heavy metal contamination.

Phytoremediation was introduced in the late 1990s as a cost-efficient, passive technique to clean up heavy metal-contaminated soil. We evaluated the phytoremediation potential of a native tree, loblolly pine (*Pinus taeda*), along a wetland corridor (Tims Branch) contaminated with uranium, nickel, and other heavy metals. Loblolly pine seedlings were planted in contaminated and uncontaminated sites along the creek (based on co-location of nickel with uranium, using a Geiger counter). In addition, a greenhouse experiment was set up to evaluate plant ecophysiological responses to nickel and flooding stress. The

factorial design included three nickel concentrations (0 ppm, 35 ppm, and 70 ppm) and two flooding conditions (flooded or non-flooded). Photosynthesis, stomatal conductance, and internal CO₂ were measured throughout the four-month study. Most of the flooded plants in the high nickel treatment died, while most non-flooded seedlings survived, suggesting a nickel by flooding interaction. Results for growth and nickel uptake in both the field and greenhouse experiments are currently being analyzed. This research will help us determine if native plant species can be used for phytoremediation of nickel-contaminated sites, and whether phytoremediation can be done in flood prone areas.

- P82 TEETS, AARON F.¹, R. TRAVIS BELOTE¹, A.L. TOM HAMMETT¹, ROBERT H. JONES¹, CAROLA HAAS¹ AND LUKE HARRIS. Virginia Tech¹—Response of medicinal plants to alternative forest management options in the Southern Appalachian Mountains.

Native plants have been used by people in the Appalachian Mountains for medicinal purposes for centuries. While over-harvesting of some species has led to local extirpations and regional rarity (e.g., ginseng), other species still regularly occur in forests throughout the Appalachians and are currently sold into local, regional, and global markets. To date, very few studies have investigated the impacts of various forest management strategies on medicinal plant species, but the conservation of these species and other non-timber forest products (NTFPs) depends on understanding how other forest uses (i.e., timber harvesting) affect their presence and abundance. We used data from an ongoing study in the Southern Appalachian Mountains to assess the impact of several forest harvesting disturbance methods on medicinal plants and other NTFPs. Presence and abundance data of medicinal plants were collected in fifteen 2-hectare plots located at three sites in western Virginia. The study included five silvicultural treatments representing various forest regeneration methods and a disturbance gradient ranging from clearcut to uncut control. We tracked changes in diversity and species-specific responses of approximately twenty medicinal plants before treatment, one and twelve years following to determine long term treatment impacts. Preliminary results suggest that the diversity of medicinal plants tended to initially increase with canopy disturbance and decreased slightly 12 years following disturbance. Species-specific abundance varied suggesting individualistic responses to disturbance. Most of these species are not highly valuable, but results suggest that several different timber harvesting options may not negatively affect certain NTFPs.

- P83 ACARO, ZACHARY, E.¹ AND ALEXA J. MCKERROW². North Carolina State University¹ and Gap Analysis Project²—Evaluating LIDAR data for characterizing canopy structure in the Croatan National Forest.

Vegetation structure is known to be a predictor of animal habitat, but characterizing structure is generally limited to field plot sampling. The goal of this project was to evaluate the use of LIDAR (Light Detection And Ranging) in characterizing forest structure. The LIDAR data was used to create an elevation surface. In order to locate treetops within this surface we looked for the local maxima (peaks) within areas assumed to represent single canopies. We used a generalized equation for pine trees as the basis for a variable sized search window used to find individual treetops. Once individual trees were identified, we calculated tree density and characterized canopy height diversity within four forested stands of the Croatan National Forest. For longleaf pine (*Pinus palustris*) stands we measured 97 trees per acre in open woodland and 136 in a closed forest. We calculated the density to be 69 trees per acre in low pocosin and 88 for the high pocosin. Compared to forest stand data our density estimates are low. The distribution of tree heights within each of the stands is distinct, with the longleaf closed stand having a high frequency of trees near 17 meters tall. In contrast, the longleaf open stand shows a very even frequency of trees throughout the range of tree heights (3-20 meters). Future work

includes refining the equations used to find individual trees based on species specific relationships between tree heights and canopy widths and developing structure indices relevant to habitat modeling.

- P84 EVERHART, SYDNEY E., HAROLD W. KELLER, AND JOSEPH S. ELY. University of Central Missouri—Role of bark characteristics and epiphyte cover in the abundance, distribution, and succession of corticolous myxomycetes (true slime molds).

Myxomycetes (true slime molds) are fungus-like organisms classified as Protista. Some myxomycete species inhabit the forest floor on decayed wood, decaying leaf litter, or the bark of living trees and vines (corticolous myxomycetes). Corticolous myxomycetes species develop on bark based on water absorption, texture, and chemical composition. The null hypothesis is that myxomycetes, bryophytes, cyanobacteria, lichens, and mosses occur in the same microhabitats based on height in the canopy, bark thickness, and water absorption. The double-rope climbing technique is used to access the tree canopy and sample every 3 m along a vertical transect at least 15 m. In 2006, bark samples were collected from Kentucky, Missouri, and Tennessee, and incubated in moist chambers. Bark of 25 trees and 25 vines will be cultured (500 cultures) and percent cover recorded. Percent cover of myxomycetes, cyanobacteria, molds, and cryptogams in five randomly selected quadrats (2 x 2 cm) for each height in the tree canopy was recorded after 32 days. The successional appearance of myxomycetes is recorded at 0, 4, 16, and 32 days. *Echinostelium minutum* appears at 2 days, whereas *Lamproderma biaspersporum* fruits after 16 days. Echinostelia appear on bark devoid of epiphytes, such as *Tsuga canadensis* and *Vitis aestivalis*. In contrast, areas retaining moisture for long periods of time favor the growth of algae, mosses, liverworts, and aphanoplasmodia and phaneroplasmodial myxomycetes with large fruiting bodies, such as *Physarum*, *Didymium*, and *Badhamia*. Data collected will quantify the abundance, distribution, and succession of myxomycete species in the tree canopy.

- P85 LATTY, ERIKA AND PAMELA CRUZ. Hollins University—Response of tree diversity to nonindigenous earthworm species introductions in Appalachian forests.

Human activities are increasingly introducing species outside of their traditional ranges and thus homogenizing the earth's biological communities. Belowground ecosystems have not been spared the introduction of nonindigenous species (NIS) and much of the eastern United States is undergoing an earthworm invasion that is having direct effects on species diversity. The effects of the introduced earthworm, *Lumbricus terrestris* (nightcrawler), on Appalachian tree diversity were tested in a mesocosm experiment. Each mesocosm was planted with seedlings of *Acer rubrum* (red maple), *Quercus rubra* (red oak), or a combination of the two species. About 15 g of *L. terrestris* were added to one half of the 120 mesocosms. Heat and hand sorting were used to ensure that the control mesocosms were truly worm free. Several environmental variables were measured throughout the growing season including soil pH, moisture, and photosynthetically active radiation. It was hypothesized that *Q. rubra*, an ectomycorrhizal species, would exhibit less stem growth in the presence of earthworms due to the relatively high proportion of belowground biomass available to earthworm grazing. In contrast, the endomycorrhizal species, *A. rubrum*, was hypothesized to exhibit little to no differences in growth between worm-free and worm-present treatments. Preliminary results after one growing season indicate that earthworm presence or absence has had no effect on the average height of *Q. rubra* or *A. rubrum* seedlings. Furthermore, no significant differences between treatments were detected in the measured environmental variables. These near term results are discussed in the context of the longer term experimental design.

- P86 FLAVIA¹, BITUSSI¹, THOMAS MCELROY¹, ROBERTH US², LUIS SIMA², JOSE LUIS ANDRADE² AND PAULA C. JACKSON¹. Kennesaw State University¹ Centro De Investigación Científica De Yucatán²—Patterns of distribution of an evergreen species (*Gymnopodium floribundum*) in a tropical dry deciduous forest: a closer look.

This study took place in Dzibilchaltun in the Yucatan peninsula of Mexico, an area dominated by tropical dry forests. As a result of both climate and thousands of years of slashing and burning, the area is characterized by a rough terrain, with extremely thin and arid soil, and scattered with thorny trees, shrubs, vines and cacti. *Gymnopodium floribundum* (family *Poligonaceae*), one of the prevalent evergreen trees in the area, presents a strong clumped distribution. Within the species, trees either have multiple stems originating from the same area at the ground, or individual trees grow in close proximity to each other. These observations led to the hypothesis that *G. floribundum* may be a clonal species. The objectives for this study were: to search for morphological evidence of clonality in this species, map patterns of distribution of potential genets, and collect leaf samples for DNA analyses. Starting at the center of a potential genet, an area of 355m² was sampled. Within this area, all tree stems were labeled and counted, all stem circumferences were measured, and leaf samples were collected. Morphological data (e.g. the presence of rhizomes) supported the hypothesis of facultative clonality in *Gymnopodium*. With the data collected in the 355m² a map was built, which will be used to associate to results of leaf DNA, and determine the extent of potential genets. The data collected in this study will serve as a basis for further research to look into the life history strategies of the species *Gymnopodium floribundum*.

- P87 WILSON, GRANDON, JOHN B. NELSON AND DANIEL L. TUFFORD. University of South Carolina—A seed bank study of a seepage wetland on the South Carolina coastal plain.

Seepage wetlands on the Coastal Plain of the Southeastern US are microhabitat within larger landscapes that may include riverine wetlands, bottomland forests, bluffs or slopes, and uplands. They normally occur at the outer edge of a floodplain or stream corridor and receive most of their water as groundwater discharge from adjacent upslope land. Site characteristics of temperature, moisture, and solar irradiance are controlled by time of year, seasonal precipitation, canopy structure, and leaf out status. This suite of factors is critical for the germination and survival of the herb layer which helps define the site specific character of the wetland ecosystem. This project is a study of the late winter/early spring dynamics of the herb layer and seed bank at a seepage wetland in Beidler Forest in Dorchester County. The site was chosen because it is part of a larger study of seepage wetland ecology. The hypothesis for this project is that actual site vegetation is different from potential vegetation in the seed bank. Quadrats of surface soil were collected at the site for germination, identification, and enumeration in the lab. Additional quadrats were delineated on-site and were visited weekly from mid-February to mid-May. Actual and potential communities were compared statistically. Continuous soil temperature and moisture probes were also deployed at the site to follow germination patterns as they relate to seasonal warming and moisture status.

- P88 VERNIER, KIM¹, VINCENT HUSTAD¹, ANDREW S. METHVEN¹, SCOTT MEINERS¹ AND ANDREW N. MILLER². Eastern Illinois University¹, Illinois Natural History Survey²—Communities of wood-decaying macrofungi associated with tree windfall in old growth prairie groves.

This study is investigating communities of wood-decaying macrofungi associated with *Quercus rubra* and *Acer saccharum* tree windfall in Brownfield (26.1 ha) and Trelease Woods (24.5 ha), Champaign Co., Illinois. These woods are remnants of a larger, pre-

settlement prairie grove and are now encircled by houses, fragmented forests, prairie and agricultural land. Although initially a virgin, deciduous upland forest dominated by oak, ash and maple with a high, closed canopy, sugar maple is rapidly becoming the dominant tree species. Beginning in November 1994, fallen trees in both woods have been tagged with an ID number, date of windfall, dbh and location relative to a network of marked grids. Data is being collected on 40 *Quercus rubra* and *Acer saccharum* logs in decay stage II and decay stage III. The following objectives are being addressed: I) Do species diversity and richness on decay stage II and decay stage III logs differ between study sites? II) Do fungal communities differ between tree species? III) Will species diversity be lost from the stand as oak is replaced by sugar maple? IV) Which environmental and abiotic variables can best explain the species composition and richness of wood-decaying fungi on logs in decay stage II and III? and V) Compare the distribution of fungal species within and on the logs.

- P89 KOONTZ, JOSHUA M. AND SCOTT B. FRANKLIN. University of Memphis—Effects of fire on riparian plant communities at Land Between the Lakes.

Fire has played an important role in shaping the distribution of plant communities. The use of fire in the United States has come full circle; heavy use in the 1800's, suppression in the 1900's, and now approximately 1,600,000 hectares each year are subject to prescribed burns in the South to achieve various forest management objectives. However, few studies have examined fire properties and behavior in Eastern deciduous hardwood forest riparian zones, thought to be refugia. Riparian ecosystems often vary from upland counterparts in vegetative composition, hydrology and fuel loading, which alter fire properties and frequency. However, with landscape burns becoming more common, effects of fire on riparian zones must be elucidated. Study sites were chosen at Land Between the Lakes National Recreation Area, a 165,000 hectare highly dissected interfluvium between Kentucky Lake and Lake Barkley. A total of 19 plots were selected, 10 sites will be burned in the spring of 2007, four were burned in the spring of 2006 and the remaining five will serve as non-burned controls. For each site, vegetative data were collected during summer 2006 and will again be collected in summer 2007. Fuel loads were collected for the four previously burned sites during the summer of 2006. For the spring 2007 burn plots, fuel loads and soil samples will be collected shortly before and again shortly after the prescribed fire. Previously burned sites showed a heterogeneous burn pattern, ranging from unburned area to those of low intensity. Fuels remained unburned throughout plots.

- P90 HUSTAD, VINCENT¹, KIMBERLY VERNIER¹, ANDREW S. METHVEN¹, SCOTT MEINERS¹ AND ANDREW N. MILLER². Eastern Illinois University¹, Illinois Natural History Survey²—Assessment of macrofungal species composition and richness in old growth prairie groves.

This study is investigating species composition and richness in macrofungi in Brownfield (26.1 ha) and Trelease Woods (24.5 ha), Champaign Co., Illinois. These woods are remnants of a larger, pre-settlement prairie grove and are now encircled by houses, fragmented forests, prairie and agricultural land. Although initially a virgin, deciduous upland forest dominated by oak, ash and maple with a high, closed canopy and fairly open (Brownfield Woods) to moderately dense (Trelease Woods) understory, sugar maple is rapidly becoming the dominant tree species. Beginning with a windstorm in November 1994 that damaged canopy trees in Trelease Woods, fallen trees in both woods have been tagged with an ID number, date of windfall, dbh and location relative to a network of marked grids. Terrestrial and wood-inhabiting macrofungi on the forest floor are being surveyed along twenty, 100 m long transects. Among the questions to be answered are: i) How does the macrofungal species composition and richness change in relation to adjacent vegetation? ii) How does macrofungi production vary within and between years?;

iii) How does macrofungi species composition and species richness change within and between years?; iv) How do tree windfalls perturb macrofungi species composition and richness patterns?; and, v) Are other parameters that influence macrofungi species composition spatially autocorrelated?

- P91 JUETT, BEVERLY, KATHERINE HOUP AND RON HOUP. Midway College—Four year succession study of vascular flora in a riparian buffer along Lee's Branch in central Kentucky.

The purpose of this study was to document changes in the plant community of a riparian buffer left undisturbed after years of mowing planted fescue to the edge of the creek. Landowners in central Kentucky especially on the horse farms are reluctant to allow these areas to grow because they see them as unkempt. They do not know what to expect in terms of plants that may grow. The vascular flora in the riparian buffer of Lee's Branch on the Midway College Campus in Woodford County, Kentucky was surveyed five times from 2002 to 2006. In May 2002, an area of 25 feet on both sides of Lee's Branch on the Midway College campus was established as a no mowing zone for 740 feet in length. The buffer was allowed to grow undisturbed. In May 2002, the buffer consisted of mowed fescue grass and orchard grass with 5 species of mature hardwoods. After 4 months, the first survey found 5 species of trees, 6 species of bushes and woody vines, 4 species of grasses, sedges and rushes, 25 species of herbaceous dicots, and 3 species of stream edge and aquatic plants. Comparison of the data through May 2006 showed an increase of 10 species of trees, 5 new bushes and woody vines, 7 new grasses, rushes, and sedges, 18 new herbaceous dicots, and 11 new aquatic or edge plants. A total of 83 species was documented and identified by October 2006.

- P92 CRABTREE, CHRISTOPHER D., HAROLD W. KELLER AND JOSEPH S. ELY. University of Central Missouri—Fungi and myxomycete species assemblages among natural communities and microhabitats at Ha Ha Tonka State Park, Missouri.

Ha Ha Tonka State Park, Camden County, Missouri, is a diverse area of approximately 1,489 hectares (3,680 acres). The park has a mosaic of hot, sunny glades, open woodlands, closed-canopy forests, and cool, shaded, limestone sinks and caves within an oak-hickory forest. These habitats and unique microhabitats allow for the possibility of interesting fungal and myxomycetes species assemblages. This research project is surveying macrofungi and myxomycete species in five community types and various microhabitats. A stratified random sampling technique is used in each unit vegetation type with a 1m² quadrat for vascular plants and a 0.01 ha circle quadrat for fungal sampling. Project objectives include a comprehensive listing of fungi and myxomycete species during a two-year period, description of habitat associations, assessment of environmental parameters, and species abundance within study plots of the herbaceous and overstory tree flora. Vegetation and overstory sampling data is used to associate and distinguish communities with fungal and myxomycete species. Environmental parameters including temperature, rainfall, relative humidity, soil composition, and photoactive radiation will be measured and analyzed for each community type. Preliminary inventory began May 14, 2006, resulting in more than 125 identified fungal and 20 myxomycetes taxa. Natural history observations, new records, and possible new species will be documented. One interesting example of the class Basidiomycetes, order Agaricales, is a Stalked-Puffball (*Tulostoma* sp.) occurring in an extremely xerophytic environment under *Juniperus virginiana*. This project is financially supported by the Missouri Department of Natural Resources.

- P93 FLOYD, ROBERT AND ROBERT CARTER. Jacksonville State University—Phytosociological history of the Pine Mountain Range, GA.

The forest of the Pine Mountain range have been shaped by a complex interaction of human and natural forces. Due to proximity to the Coastal Plain, the forest are composed of both Coastal Plain and Piedmont/Appalachian species. Records from the 19th and early 20th centuries indicate that fire was a part of the landscape and perpetuated pine species, especially longleaf, as a component of the forest. Reduction in fire frequency, introduced disease, and agricultural practices have altered the structure and function of forests in the Pine Mountain Range.

- P94 CARTER, ROBERT, BRETT RUSHING, JOSH FORREST AND BRENT ABERNATHY. Jacksonville State University—Plant communities of the Dugger Mountain Wilderness, Talladega National Forest, Alabama: Preliminary results.

Plant communities were identified in the Dugger Mountain Wilderness on the Talladega National Forest through multivariate analysis of vegetation data. Steep slopes with shallow soils were dominated by chestnut oak and hickories. Coves and stream borders were dominated by yellow-poplar and red maple, while dry ridgetops with dry soil were dominated by longleaf and Virginia pines. Lowbush blueberry was common on all sites except for coves and stream margins.

P95 CANCELED: NOW POSTER 135

- P96 ECHOLS, LEE. University of Georgia—Vascular flora of the remnant blackland prairies of central Georgia.

Blackland prairies are a globally imperiled, rare plant community only recently discovered in central Georgia. A floristic inventory was conducted on six remnant blackland prairie sites within Oaky Woods Wildlife Management Area (WMA) during the 2005-2006 growing seasons. The 49 ha site complex has yielded 352 species in 213 genera and 86 families to date. Three species new to the state of Georgia were documented. Seven state listed rare taxa, one Candidate for Federal Listing and one Federally Endangered species are reported here as new records for the Oaky Woods WMA vicinity.

- P97 VANDEGRIFT, A.W., R. TRAVIS BELOTE AND ROBERT H. JONES. Virginia Tech—Increases in soil organic matter following canopy disturbance mediates soil nutrient responses to timber harvesting intensity.

Responses of forest soils to management activities strongly influence ecosystem processes and the sustainability of forest practices. Immediate effects of timber harvests on soils are well known and include compaction and erosion. Long term effects are less clear due to the scarcity of replicated studies of long duration. In a study of forest management alternatives applied to Appalachian oak forests, we collected and analyzed soil samples from the A-horizon 12 years after disturbance. Five silvicultural disturbance treatments, representing alternative management practices and a gradient from no disturbance (uncut) to heavy disturbance (clear cut) were included in the study. Percent organic matter (OM) tended to increase with disturbance as did base cations (e.g., Ca, K, Mg), probably because of residual slash and coarse woody debris left on the harvested sites. Because many cations and nutrients are correlated with OM, we examined the effect of the different logging treatments on various cation levels while statistically controlling for OM (i.e., we included OM as a covariate). After controlling for changes in OM, we found that disturbance treatment effects were only significant for Mn, Cu, and percent acidity. These results indicate that stem-only harvesting tends to increase soil nutrients, even in the stem exclusion stage of forest development, reinforcing the benefits of this practice.

P98 CANCELED

- P98B PERKINS, FERN S., HOWARD S. NEUFELD, MELANY C. FISK AND JOHN F. WALKER. Appalachian State University—Increased nitrogen deposition and the green alga lichen *Umbilicaria mammulata*: too much of a good thing?

Umbilicaria mammulata is an umbilicate foliose green algal lichen found throughout the Appalachians and Great Lakes area on siliceous rock. It relies on atmospheric deposition for nutrients, including fixed N. Due to human activities atmospheric N has quadrupled and is projected to double again by 2050. Lichens were collected from Maine (low deposition) to West Virginia (high deposition). Lichens from low, moderate, and high N deposition sites will be placed in a growth chamber and fertilized with pre-industrial (1/4 ambient), ambient, or projected 2050 (2X ambient) levels of N for 6 months using NH_4NO_3 . Lichens will also be fertilized *in situ* with ambient N (to total 2X ambient) at 5 sites near Boone, NC for 6 months. Fungal and algal metabolites (Chl a, ergosterol, chitin, arginine), thallus C and N, and chlorophyll fluorescence will be analyzed for lichens collected along the N gradient and after fertilization. Chl a is an indicator of photosynthetic capacity and total algal biomass. Ergosterol, a sterol of fungal plasma membranes, is an indicator of active fungal biomass. Chitin, a component of fungal cell walls, is an indicator of total fungal biomass and N investment in fungal tissue. A higher Chl a:ergosterol or Chl a:chitin in fertilized vs. control lichens would indicate a greater investment in the photobiont. This study will elucidate effects of realistic levels of increased N deposition on the lichen *U. mammulata*, the two symbionts, and the potential to act as a fixed N sink.

Microbiology

- P99 BLANKINSHIP, LISA ANN¹ AND JOSEPH J. GAUTHIER². Troy University¹ and the University of Alabama at Birmingham²—Survival of bacteria during aerobic digestion.

During aerobic digestion of waste solids, microorganisms are maintained under starvation conditions for 35 days. During this time waste solids should become stabilized which will reduce odor problems in the final product, decrease microbial biomass that must be disposed of, and deactivate pathogenic microorganisms. The purpose of this project was to determine the reduction of total microbial cells and viable microbial cells throughout the 35 day period of aerobic digestion. Individual bacterial isolates from sludge samples were also observed for a 35 day period in either sludge supernatant or sludge pellet to determine which phase favored long-term survival. It was found that a change of 1-2 logs occurred in the total number of cells and viable cells throughout the 35 day digestion period with the majority of cell decrease occurring by day 20. Individual bacterial isolates were found to be capable of long term survival in both sludge supernatant and pellet fractions.

- P100 ARZU-THOMPSON, KANDIS¹, W. LENA AUSTIN¹, RUEL MICHELIN² AND L. FREDERICK¹. Howard University¹ and Morgan State University²—Observations on the effect of culture filtrates of a strain of *Bacillus mojavensis* on germination of spores of *Alternaria* and *Ulocladium*.

The effect sterile filtrates from potato-dextrose broth shake cultures of a strain of *Bacillus*, designated HU Biol – II and tentatively identified as *Bacillus mojavensis*, have on the germination of spores of *Alternaria alternata* and *Ulocladium* sp. has been investigated. This isolate is known to produce substances that inhibit mycelial growth of fungi. The extent to which spore germination of fungi may be inhibited by antifungal components of this bacterium has not been critically examined. Studies on this matter are underway and preliminary results are reported here. Dilute suspension of spores from potato-dextrose

agar cultures of each fungus have been spot plated on plain microscope slides and after air-drying a drop of the filtrate, the culture broth, and sterile distilled water were respectively placed on each spot. Each test consisted of five slide preparations with three spots per slide. Slides were placed on V-shaped glass rods in sterile glass Petri plates that contained a water-saturated sheet of sterile filter paper. They were incubated at 25 C for 18 to 24 hours. The number of spores germinating under each test condition was determined as well as the pattern of spore germination. Slender hyphal strands emerged from cells of the many-celled spores of both fungi placed in culture broth and water. Only germ vesicles emerged from cells of the filtrate-treated spores. Components in the filtrate appear to suppress spore germination. Investigations are underway to determine whether concentrating the filtrate would completely suppress spore germination. Similar tests are also planned with spores of several other fungal species.

- P101 STORRS, LUKE, DAVID GREENE, ANDREW COOMBS, DEVIN OWENS AND MICHAEL LAND. Northwestern State University—Survey of *Salmonella* spp in *Anolis carolinensis* and methods of pathogen reduction.

The common green Anole (*Anolis carolinensis*), or porch lizard, is the only anole that is native to the United States. There are six other *Anolis* species that are native to the Caribbean islands. As a result of released or escaped pets, there are now over thirty six species of non-native anoles breeding in the Southeastern United States. Their diet consists of mainly insects are diurnal and the habitats range from terrestrial to aboral. These lizards are easily caught and are also sold commercially. Reptiles in general have been found to be reservoirs of *Salmonella* spp and implicated in Salmonellaosis sickness. Green anoles were collected from different areas of Louisiana and tested to see if *Salmonella* spp. were present in the alimentary tract. Methods to eliminate *Salmonella* were also investigated.

- P102 THOMASON, KATHERINE, WALSH THOMAS AND MIN-KEN LIAO. Furman University—Diversity of the *Escherichia coli* population in Furman Lake, the Furman Golf Pond, and the feces of Canada Geese.

Furman Lake and Furman golf pond are geographically similar bodies of water with adjacent drainages and comparable water chemistry and climate. However, our previous data revealed that *Escherichia coli* concentrations are consistently higher in Furman Lake than in the golf pond. The major difference between Furman Lake and the golf pond is that Furman Lake hosts a larger population of birds, especially Canada geese. Hence, in this study, we isolated and characterized *E. coli* in Furman Lake, the golf pond, and the feces of Canada geese inhabiting Furman Lake. We hypothesized that the *E. coli* diversity in the two bodies of water would be different because of the larger animal input in Furman Lake. To compare the diversity of these three *E. coli* populations, we determined the ECOR type (A, B1, B2 or D) of each isolate. These four major phylogenetic groups (A, B1, B2, and D) were proposed based on the genomic analyses of environmental *E. coli* isolates. In this study, 249 *E. coli* isolates were typed: 131 from Furman Lake, 45 from the golf pond, and 73 from Canada geese feces. Chi square analyses showed groups to be significantly different from one another ($p < 0.05$) with further analyses indicating that the distribution of genetic types in Furman Lake more closely resembled that of the Canada geese feces ($p > 0.01$) than did the golf pond ($p < 0.01$). Hence, we concluded that Canada geese have a larger impact on both the number of *E. coli* and their genetic diversity in Furman Lake.

- P103 CHRISAWN, CHARLIE¹, MIDDLETON CHANG¹, DAVID WESSNER¹, DAVID GLICK² AND CHRISTOPHER J. PARADISE¹. Davidson College¹ and King's College²—A comparative analysis of microbial diversity in simulated aquatic treehole ecosystems.

Treeholes are small, detritus-based aquatic habitats. Larvae of detritivores that live in treeholes consume bacteria through filter feeding and scraping detritus. Many factors, in addition to grazing by mosquitoes, may affect abundance and diversity of bacteria. We sought to determine the extent of bacterial diversity in treeholes and which biotic and abiotic factors, if any, were influential in determining bacterial diversity. Our study focused on twelve field mesocosms on the Davidson College Ecological Preserve (Davidson, NC) that were part of an experiment testing effects of leaf litter abundance and predation on diversity and abundance of insect detritivores. We isolated total DNA from water samples collected from the artificial treeholes at three different time points during the summer of 2006. We then amplified a fragment of the bacterial 16S ribosomal RNA gene using bacteria-specific PCR primers. After individual PCR amplicons were cloned, we used restriction enzymes to digest the desired DNA sequences, and ran the samples on agarose gels. By examining the resulting banding patterns, we estimated bacterial species richness within each mesocosm, for each sampling, and collectively for the pooled community. Next we confirmed our findings by amplifying a portion of the 16s rRNA gene and running those fragments in temporal temperature gradient gel electrophoresis (TTGE). Finally, we compared bacterial diversity to other biotic factors, with the hypotheses that high levels of resources would increase richness of the bacterial community, as would the presence of top predators, by reducing densities of detritivores and freeing bacterial communities from grazing pressure.

P104 SMITH, ARIEL¹, PAULA JACKSON¹, JOSE LUIS ANDRADE² AND THOMAS MCELROY¹. Kennesaw State University¹, Centro De Investigacion Cientifica De Yucatan²—Analysis of fungal community diversity associated with dominant tree species from the Yucatan Peninsula, Mexico.

The rapid urbanization in Mexico poses a potential threat to the dry tropical deciduous forest of the Yucatan Peninsula; thus, it is essential to protect the availability of fresh water in that area. However, there is a lack of knowledge on how these dry tropical trees obtain their water resources. Local tree species distributions may be driven by microbial associations that affect their ability to use ground water and soil nutrient pool resources. Therefore, it is important to understand the relationships between co-occurring plant species and associated microbes. To identify underground root tissue this study created a DNA sequence database (chloroplast trnL (UAA) intron) for some tree species from the Yucatan Peninsula, Mexico. To identify associated microbial communities Terminal Restriction Fragment Length Polymorphism (TRFLP), a culture independent method, was used to analyze the microbial communities. Root and soil samples were collected from the field site. Whole genomic DNA was extracted from the tissue and associated soil samples. The trnL intron of the plant genome was amplified and sequenced. The DNA sequence was compared to the local database for identification. The ITS region of the fungal genome was subjected to PCR amplification with fluorescently labeled primers. The amplicons were cut with *Taq*I endonuclease restriction enzyme and the fragments were analyzed with an ABI 310 Genetic Analyzer. Differences in microbial community composition associated with different tree species will be discussed.

- P105 KIRKER, G.T., S.V. DIEHL AND M.L. PREWITT. Mississippi State University—Effects of chlorothalonil (CTN) and butylated hydroxy toluene (BHT) on microbial communities involved in deterioration of wood using terminal restriction fragment length polymorphism (T-RFLP) analysis: Results from field study.

The effects of Chlorothalonil (CTN) and Butylated Hydroxy Toluene (BHT) on microbial species diversity in wood and the surrounding soil are being assessed by Terminal Restriction Fragment Length Polymorphism (T-RFLP). CTN is a compound currently being evaluated as a wood preservative, and BHT is currently being evaluated for its synergistic effects with CTN. Data will be presented from research that is currently underway. TRFLP data is being analyzed to determine significant differences in patterns of microbial colonization over time due to wood preservative treatment in southern yellow pine (SYP) both above and below ground. Preliminary results show decreases in fungal and bacterial phylotype diversity for both the above and below ground portions of preservative treated SYP wood samples. Of particular interest is the absence of Basidiomycete fungi in the below ground sections treated with CTN+BHT when compared to untreated controls as well as differences in bacterial diversity at differing test sites. Characterization of these pattern shifts will provide a better understanding of the biology and ecology of wood decay microorganisms as well as the effects of biocides on the microbial community in treated wood and in the soil. Retentions of wood preservatives are being analyzed using HPLC and GC to determine percent loss of preservative over time for each treatment and also to determine if different microbial assemblages of fungi, including molds, stains, and wood decay, as well as bacteria may be contributing to preservative breakdown.

- P106 KNIGHT, CHINYERE¹, W. LENA AUSTIN¹, RUEL MICHELIN² AND L. FREDERICK¹. Howard University¹ and Morgan State University²—The induction of a dark strain of *Bacillus mojavensis* as an endophyte in corn and cotton plants.

Previously reported studies on a strain of *Bacillus*, tentatively identified as *Bacillus mojavensis*, that was isolated in our laboratories, have shown that this strain, designated HU Biol-II, elaborates substances with antifungal properties. Earlier, Bacon and Hinton reported that a strain of *B. mojavensis* isolated in their laboratory from a grain of corn has antifungal properties and can be induced to become established as an endophyte in corn and bean plants. We have conducted studies to ascertain whether strain HU Biol-II, isolated from a building air vent, could also be induced to become an endophyte in plants. The plants chosen for our investigation were corn and cotton. Surface sterilized grains of corn and seeds of cotton have been surface treated with a suspension of bacteria and planted in pots of sterile soil. Surface sterilized but untreated seeds were planted as controls. Stems segments were removed from treated 3 to 4-week-old corn seedlings and from six to eight-week-old cotton plants, as well as from controls, minced, and plated on potato-dextrose agar (PDA) plates to assay for the presence of bacteria. Colonies of bacteria emerged from some of the tissues pieces of treated seedlings but did not develop in control plates. Recovered cultures from both corn and cotton plants have been tested for antifungal properties against four test fungi, namely, *Neurospora dodgei*, *Botrytis* sp., *Zygorhynchus* sp, and *Fusarium* sp. Inhibition of mycelial growth of the fungi challenged by the recovered cultures has been similar to that of the original stock culture. Results from these preliminary studies have implications for the probable use of this strain as a biocontrol agent for fungal diseases of these and other plants. Supported by – NSF/LSAMP grant to Howard University

- P107 THOMAS, DEATON AND PREMILA N. ACHAR. Kennesaw State University—Intraspecies variation in *Aspergillus flavus* in Georgia peanuts.

Aspergillus flavus can invade peanuts in the field before harvest, during harvest, in storage and transportation. Aflatoxins are secondary metabolites produced by *Aspergillus*

species and are carcinogenic in humans. Several strains of *A.flavus* exists in peanut growing areas in Georgia, however, their virulence varies with geographical distribution. A number of molecular techniques are currently available for studying genetic relationships between fungal populations. In the present study we used polymerase chain reaction (PCR) to establish genetic diversity among isolates of *A. flavus* from peanut growing areas in Georgia. For cultural characterization, isolates were transferred onto PDA plates and incubated at 30°C. After 7 days of incubation, based on morphology and colony character, potential colonies were screened for *A.flavus*. Monoconidial colonies were checked under stereomicroscope, then transferred onto PDA plates and incubated at 25°C in the dark. All strains were stored on either PDA slants or Petri dishes. Fungal DNA was isolated using standard protocol with slight modification whenever necessary. PCR amplification of genomic DNA was performed using universal (ITS) 1 and (ITS) 4 primers. PCR amplification of ribosomal DNA for *A.flavus* revealed one common band of approximately 600 bp for all the isolates, although 2 of the isolates showed a slight variation. This variation appeared only in the toxigenic forms of *A.flavus* used in this study. Restriction digestion of PCR products with specific enzymes and sequencing of the same may give additional information of the molecular relatedness of different isolates, the toxic and the non-toxic forms of *A.flavus* in Georgia peanuts.

P108 WAND, JULIA AND PREMILA N. ACHAR. Kennesaw State University—Molecular characterization of *Aspergillus flavus* in Georgia peanuts using RAPD and PCR.

Aspergillus flavus, a fungal mold, is a common contaminant of peanuts. *A. flavus* produces aflatoxins which are known to be both carcinogenic and highly toxic, threatening humans, livestock and crops. While the US already has in place regulations to monitor aflatoxin contamination levels, many poor nations either do not have or fail to comply with regulations resulting in aflatoxins making it to market. While many techniques for fungal detection exist, it is important to find quick and accurate methods that yield readable results. In this study, we compared PCR and RAPD to detect *A. flavus* in contaminated peanuts from Georgia. Peanuts from supermarkets were plated on potato dextrose agar and incubated at 30°C. After 7 days of incubation, based on morphology and colony character, potential colonies were screened for *A.flavus* and confirmed by PCR_RAPD. Fungal DNA was isolated using standard method. Ribosomal DNA (rDNA) was amplified using polymerase chain reaction with the universal primers, internal transcribed spacer (ITS) 1 and (ITS) 4. For RAPD reactions, UBC primers 226, 245 and 300 were used. PCR results showed that ITS amplicons for *A. flavus* ranged from 600 to 650 bp. We predicted that for RAPD, ITS region of *A.flavus* should show consistent results with PCR when amplified. However, as the name implies, the sequences amplified in RAPD were random and thus lacked the specificity of PCR. Furthermore, a large amount of DNA fragments were needed for RAPD compared to PCR.

P109 IBIJOKE, AKINJOBI AND PREMILA N. ACHAR. Kennesaw State University—Interspecies variation in three different species of *Aspergillus* in Georgia peanuts.

Detection of fungal infection is important before peanuts reach market, and more important is the detection of aflatoxin producing *Aspergillus*. Several methods have been developed for the detection of fungal infection in peanuts, unfortunately most of these methods have limitations and misidentification. Molecular approaches are now being developed to provide a more rapid and objective identification of fungi compared to traditional phenotypic methods. Protocols for the DNA-based diagnosis of *Aspergillus* species have recently been developed. The polymerase chain reaction (PCR) has revolutionized the detection of certain pathogens from field samples, including potentially aflatoxin producing *Aspergillus* species. In the present study our aim was to develop PCR based protocols in order to investigate interspecies variation at the molecular level among

the following three species of *Aspergillus*: *A.flavus*, *A.niger*, and *A.parasiticus* from contaminated peanuts in Georgia. DNA was isolated by use of a commercial kit. A comparative analysis at the molecular level between aflatoxin vs. non-aflatoxin producing strains of *A.flavus* and *A.parasiticus* was also performed. The utility of the large-subunit RNA gene D1-D2 region, and internal transcribed spacers 1 and 4 (ITS1 and ITS4) as targets for the molecular comparison of *A.flavus*, *A.niger*, and *A.parasiticus* was assessed. Our results indicate that interspecies variation among the three isolates is minimal in their ITS1 and ITS4 sequences, and at the molecular level there is no significant difference between aflatoxin vs. non-aflatoxin producing strains of *A.flavus* and *A.parasiticus*.

- P110 CHO, IN KI, ALICIA WHATLEY, AND CHRISTI MAGRATH. Troy University—Yeast microarray analysis of environmental samples from a wastewater treatment plant.

The Troy Wastewater Treatment Plant (WWTP) in Troy, AL treats wastewater to the secondary level and the water quality of Walnut Creek below the WWTP has been classified as moderately impaired. Previous analysis of lead acetate suggested that microarray analysis can be used to analyze the impact of xenobiotics on living organisms with high sensitivity. Therefore, to complement studies designed to overcome the limitations of contemporary water quality monitoring methods, this study utilizes microarray analysis as a method of assessing the impact of wastewater on gene regulation and expression patterns in a model eukaryotic system. Using microarray analysis, gene expression differences between water and samples collected from areas upstream and downstream of the WWTP can be quantified and analyzed. Therefore, sample collection and chemical analysis, followed by microarray analysis will enable a thorough assessment of the molecular impact of the effluent water from the WWTP on a simple biological community.

- P111 CHO, YOON AND CHRISTI MAGRATH. Troy University—Direct assessment of transcription termination activity as transcription levels vary in *Saccharomyces cerevisiae*.

Analysis of termination of transcription in eukaryotes requires a mechanism to allow precise control of termination activity. Previous studies have utilized a reporter construct with an intron-imbedded termination sequence upstream of a *LacZ* gene segment as an indirect indicator of transcription termination activity, where β -galactosidase enzyme activity indicated failure to terminate transcription. Coupling the reporter system with a galactose inducible promoter and varying the carbohydrate level in the growth media indicated an inverse correlation of termination levels with the concentration of galactose: the level of transcription increased and the level of effective transcription termination seemed to decrease as the concentration of galactose increased. In this investigation, Northern Blot analysis was used to detect and quantify mRNA levels produced during transcription activation of the reporter construct by galactose, allowing direct assessment of termination activity and confirming the feasibility of the reporter construct for investigations of transcription termination activity.

Genetics, Cellular and Molecular Biology

- P112 BELL, BRITTNEY L. AND STEPHEN C. LANDERS. Troy University—Endocytosis and digestion in the parasitic dinoflagellate *Haplozoon*.

Haplozoon is a parasitic dinoflagellate found within the digestive tract of bamboo worms (Polychaeta, Maldanidae). Endocytosis in this chain of cells is not understood well, particularly with regard to the more posterior cells in the chain. Endocytosis and digestion

in *Haplozoon* were studied using nigrosin, neutral red, acridine orange, and DQ Red BSA (Molecular Probes). *Paramecium* was the control organism for our experiments. Nigrosin staining of live cells demonstrated the ability of the trophocyte (anterior cell in chain) and gonocytes (cells located posterior to the trophocyte) to endocytose the tracer. Neutral red and acridine orange staining demonstrated multiple acidic vesicles in the trophocyte and gonocytes, within peripheral vesicles near the pellicle as well as within deeper internal vesicles. Weak staining with Red BSA indicated that the trophocyte is able to internalize and digest the tracer. The rapid ability of the cells in this dinoflagellate chain to internalize nigrosin suggests that the trophocyte and gonocytes have the ability to ingest food, and that the gonocytes are not reliant upon the anterior trophocyte for nutrition. Neutral red and AO staining demonstrate acidic compartments within the chain, possibly used during food digestion.

P113 CANCELED: SEE TRI-BETA POSTER SESSION

P114 WELLINGTON, ALLEN S. AND TED ZERUCHA. Appalachian State University—Identification of a Highly Conserved *Meis*-Linked Gene.

We have identified a previously unstudied gene that is linked to the *Meis2* homeobox gene using a comparative genomics approach. This gene is remarkably well conserved in all vertebrates examined, but shares no obvious similarity with any previously identified gene. We have named this gene *M2lg* (for *Meis2* linked gene). Interestingly zebrafish (*Danio rerio*) appear to contain two paralogs of this gene while tetrapods contain one. This is consistent with what would be predicted based on the genome duplication event which occurred in the teleost lineage following its divergence from the lineage that would give rise to tetrapods. Comparisons of the two zebrafish paralogous genes to the single tetrapod homologues is providing the opportunity to gain insights into how genes may be preserved following duplication events and thus how genes and genomes evolve.

P115 ZAYNER, JOSIAH AND ECE KARATAN. Appalachian State University—Regulation of *Vibrio cholerae* biofilm by NspS.

Vibrio cholerae is a gram negative bacterium and the pathogenic agent of the human disease cholera. *V. cholerae* is known to inhabit aquatic environments and spread through the contamination of drinking water and food. Many species of bacteria including *V. cholerae* can create multicellular interacting structures surrounded by an exopolysaccharide matrix called biofilms. These biofilms provide bacteria with protection against environmental factors. Biofilm created by the *V. cholerae* is thought to provide persistence in the environment and lead to its pandemic nature. NspS is a putative periplasmic protein found in *V. cholerae* that has been shown to up-regulate biofilm formation. The polyamine norspermidine up-regulates *V. cholerae* biofilm levels in an NspS dependent manner suggesting an interaction between this polyamine and NspS. Furthermore, NspS has sequence similarity to the spermidine and putrescine binding proteins of *E. coli* PotD and PotF, respectively. We hypothesize that norspermidine binds NspS and this binding leads to up-regulation of biofilm formation. To test the hypothesis we performed site-directed mutagenesis of the predicted norspermidine binding residues in NspS. These residues obtained through homology modeling using PotD and PotF were shown to be W31, D90, E173, W261 and D263. An E173A mutation resulted in a 50% decrease in biofilm formation whereas mutations of both W261 and D263 to alanines led to a complete loss of NspS function similar to that of a *nspS* null mutant. These results suggest that norspermidine binds NpsS at the predicted binding site and that this binding contributes to wild-type levels of biofilm.

- P116 LOMENICK, BRETT AND MARGARET KOVACH. University of Tennessee-Chattanooga—Correlating gene expression with non-coding microsatellite instability in colorectal cancer.

Genomic instability is a molecular feature common to the progression of many cancers. Two forms of genomic instability occur in cancer: chromosomal instability and microsatellite instability (MSI). Microsatellites are a class of repetitive DNA sequences consisting of simple tandem repeats, typically 2-5 nucleotides in length, that are found uniformly dispersed throughout the genome of an organism. The MSI phenotype is characterized by variability among individual cancer cells in the number of tandem repeats at given microsatellite loci. Many microsatellite sequences occur within genes, and functional consequences are possible where these sequences are variable. Less is known about the effects of microsatellite variability that occurs in the non-coding regions of genes. It is hypothesized that this variability can affect gene expression, mRNA stability, and splicing of transcripts. The purpose of this study is to evaluate the effect of MSI on gene expression using human colon cancer as a model. Seven candidate genes known to be involved in colorectal cancer progression were chosen for analysis. Preliminary evaluation of these genes shows considerably more microsatellite variation in MSI+ lines than in MSI- lines, particularly in sequences located in the first intron and 3' UTR; these areas are known to exhibit control over expression levels. Expression of candidate genes exhibiting cancer-specific microsatellite instability was evaluated by northern analysis and *in vitro* run-off transcription assay in established colorectal cancer cell lines. The student T-test was used to determine if there is a statistically significant correlation between repeat length and expression levels for each gene.

- P117 SHALABI, RULA, KATIE MITCHUM AND ELI HESTERMANN. Furman University—Similar AHR ligand responses of reporter gene and endogenous CYP1A1 expression in H1G1 mouse hepatoma cells.

The aryl hydrocarbon receptor (AHR) is a ligand-activated transcription factor that controls the toxic and carcinogenic effects of its ligands by regulating the expression of many genes including cytochrome p450 1A1 (CYP1A1). While the environmental contaminant, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin, is the most potent and widely studied AHR agonist, identification of other agonists is needed. Furthermore, the identification of AHR antagonists provides a possible solution to the harmful effects caused by AHR agonists. Many ligands with antagonist properties have been proposed but with conflicting supporting evidence. In this study, the agonistic and antagonistic effects of several AHR ligands were tested in H1G1 cells transfected with a green fluorescent protein reporter (GFP) gene. The time and expense of isolating RNA makes it desirable to identify a reporter gene construct that accurately predicts the effects of AHR ligands on endogenous gene expression. To determine the accuracy of the GFP reporter gene construct in H1G1 cells, the effects of the ligands on endogenous CYP1A1 expression were measured using real time RT-PCR. The best antagonist, 3',3'-diindolymethane, inhibited gene expression in both the reporter gene and endogenous gene. A reported AHR antagonist, 3'-methoxy-4'-nitroflavone, was a partial agonist. Partial agonism was also seen in 6-methyl-1,3,8-trichlorodibenzofuran and α -naphthoflavone. Results from both the reporter gene and endogenous CYP1A1 gene were similar, suggesting that the reporter gene is a good mechanism for predicting the effects on endogenous gene expression. Future studies should be conducted to test the response to these ligands in human cell lines.

- P118 BRAIK, SUSAN AND NICHOLAS SCHISLER. Furman University—Phylogenetic distribution of introns in eukaryotic genomes revisited: a statistical comparison.

Introns are non-coding DNA sequences in eukaryotes that interrupt the protein coding sequences of genes and are spliced out prior to protein translation. Of the 3.2 billion

bases in the human genome, roughly 35% are intronic. All species contained in a Genbank-derived intron sequence database, including 30 completely sequenced representative eukaryotic genomes, were compared on the basis of intron sequence length, penetrance (percentage of genes containing introns), and the number of introns per gene normalized to 1 kb and the results mapped to a phylogeny based on rRNA. For those species that were not completely sequenced, BLAST similarity comparisons against completely sequenced genomes were used to identify variation due to sampling error. It was found that fungi and insects had smaller intron sequence burdens (i.e. fewer and/or shorter introns) compared to most plants and animals. Among the fungi, *Hemiascomycetes* tended to have fewer introns per gene, whereas *Euascomycetes* and *Basidiomycetes* had shorter introns. Insects tended to use both strategies to reduce intron sequence burden. Such studies should provide useful insights into the evolution of non-coding DNA sequences within eukaryotic genomes.

- P119 STRAND, DESEREA, WILLIAM ENSIGN AND THOMAS MCELROY. Kennesaw State University—Genetic characterization of the stone roller (*Campostoma oligolepis*) in the Etowah River system.

Campostoma oligolepis, the common stone roller found in the Etowah River ecosystem, is an abundant species which can be used to assess the conservation implications of severing the connectivity of a water system that is home to many species. We have examined the variability at several highly variable genetic loci (STR, microsatellites) among 6 populations of *C. oligolepis*. We have combined these data with hydrologic and ecological data collected from study sites to describe population dynamics and analyze the spatial genetic structure. Our work has a direct impact on 1) the understanding of fish movement and gene flow in the Etowah River ecosystem for which there is currently very little information; 2) delineation of the impacts of natural and artificial barriers to fish movement and spatial genetic structure; 3) the ability to link hydrology and ecological dynamics to identify potential driving forces behind spatial arrangements of genetic variation. We tested the following hypotheses: 1) populations above and below Allatoona Dam are genetically distinct, (2) anthropogenic change strongly influences population dynamics and genetic structure causing the magnitude of genetic difference between pairs of sites to be related to hydrological disturbance patterns rather than the geographic river distance separating them; however, in regions where the river is relatively undisturbed genetic differences will be driven primarily by isolation by distance (IBD). Our data suggests that the populations above and below Allatoona Dam are genetically distinct. Further, anthropogenic disturbance significantly impacted connectivity among sites.

- P120 MORGAN, SHERILYN AND BRADFORD BRADEN. Bowie State University—Determine the structure of crystallized cryoimmunoglobulin, IgG Sch, by vapor diffusion and x-ray diffraction.

Cryoimmunoglobulins are abnormal immunoglobulins that aggregate when exposed to cold temperatures less than 37°C. The mechanism of cold-induced precipitation, though not well understood, may be a product of genetic mutation of the germ line sequence, which possibly affects affinity maturation of normal antibodies. Human type I cryoimmunoglobulin, IgG Sch, were crystallized by vapor diffusion in a solution of 16% PEG 2000, 0.2 Ammonium sulfate, 10% iso-propanol and 10% pH 3.6. Upon optimal crystal growth, x-ray diffraction will be performed to further determine the protein structure and the sequence will be later elucidated. Through data analysis, these cryoglobulins can be used as a model of amyloid formation.

- P121** **CANCELED**

Invertebrate Zoology and Entomology

- P122 RELLINGER, ERIC J., JUSTIN L. TANK AND JAY A. YODER. Wittenberg University—Maternal control on the capacity for water vapor absorption in ticks.

This study is based upon an unusual observation that was made during routine storage of American dog tick larvae, *Dermacentor variabilis*. Typically, we hatch and keep larvae for many months at 85% RH, a hydrating atmosphere above their critical equilibrium humidity (CEH). In certain batches, whole vials of larvae at 85% RH were found dead, as though CEH had disappeared. These larvae were traced to mothers that had been moved to 97% RH to make room for other ticks; usually the same relative humidity is used for oviposition and hatching, which is why this effect on mortality has gone by unnoticed. A water balance experiment was conducted on resultant larvae from females that had been placed at different relative humidities. Regardless of relative humidity, there was no difference in date of oviposition, guanine accumulation and hatching, or in water content, dehydration tolerance and net transpiration rate of larvae. For larvae that developed at low relative humidity, CEH was between 75% RH - 85% RH, whereas with development at higher relative humidity, CEH was 93% RH - 97% RH, which made these larvae incapable of surviving at 85% RH. Switching tick mothers on day of oviposition between low and high relative humidities, exhibited resultant larvae that retained CEH associated with moisture conditions experienced by the mother, not by the eggs. Thus, CEH of larvae reflects moisture level where the mother drops from the host and safeguards against overhydration when conditions are too wet.

- P123 TANK, JUSTIN L.¹, JAY A. YODER¹, HORTON H. HOBBS, III¹ AND BRYAN L. BROWN². Wittenberg University¹ and Clemson University²—Water relations of adult branchiobdellids from different crayfish hosts.

To examine how branchiobdellids are adapted for a freshwater habitat on their crayfish hosts, we determined water balance characteristics for *Cambarincola ingens* from North Carolina and *C. fallax* from Ohio. Both had an elevated 75% body water content, in that they are hyperosmotic to freshwater, and a high net transpiration rate, displaying a typical Boltzmann temperature function, which agrees with a strategy that emphasizes water loss to counter constant water gain from the environment. Differences were that *C. ingens* was 5x larger than *C. fallax*, net transpiration rate for *C. fallax* was 2-fold faster, 11%/h compared to 5%/h for *C. ingens*, and activation energy was higher for *C. fallax* (43kJ/mol), suggesting that they were more porous than *C. ingens* wherein activation energy (26kJ/mol) was suppressed. Thus, *C. fallax* relies on high net transpiration rate focusing on elimination (greater water turnover), while larger body size modifies *C. ingens* for water retention and shifts the priority to low activation energy that restricts the amount of water that enters the body. There was no obvious connection implying that water balance is favored by sites selected on the crayfish's body (subrostral or branchial chamber) or preference for region (pool or riffle) of the stream. The ability of *C. ingens* and *C. fallax* to survive with a low water content down to 1/2 their body mass, however, enables them to cope with excess water in their environment by losing water rapidly.

- P124 SNYDER, AMY, JENNIFER ZETTLER AND GREGORY KNOFCZYNSKI. Armstrong Atlantic State University—Melanin distribution in Parnassian butterflies in relation to altitude changes.

Melanistic pigment variations are common in many species of white Parnassian butterflies (*Parnassian spp*). We wanted to determine if the distribution and abundance of melanin on the hind wings of *P. clodius* and *P. phoebus*, were correlated with elevational changes (2,549 m to 1,402 m) in the butterflies' habitats. We collected a total of 23 male Parnassian butterflies on Jackson's Peak in Wyoming and returned them to the laboratory

in Savannah, Georgia where melanin levels were categorized. Each collected butterfly was photographed at a focal length of 38 mm and an image of a 1.0 cm² box on the base of the hind wing was used by volunteers to rank melanin amounts with a stippling scale. We found that *P. phoebus* populations collected at higher elevations were darker than their counterparts at lower elevations. No altitude differences were noted for *P. clodius*, however. Based on these results, the darker wings *P. phoebus* may represent a thermoregulatory adaptation that is not present in *P. clodius*.

- P125 GONSALVES-JACKSON, DEIRDRE. Virginia Wesleyan College—Opisthobranch mollusks from the Eastern Shore of Virginia (Mollusca: Gastropoda: Opisthobranchia).

Few studies exist documenting the diversity of opisthobranch mollusks (sea slugs) from the Eastern Shore of Virginia and to date only 21 species have been recorded. The goals of this ongoing research have been to survey and document the diversity of marine slugs in the Atlantic waters of the Eastern Shore and the Chesapeake Bay. This has been accomplished through methods of collection, such as snorkeling and wading, followed by morphological and internal examination and culturing of specimens in the laboratory. To date seven sites have been sampled (5 Atlantic and 2 Bay sites) during an eight-week period from June – July 2005. Two species in two families have been identified. Both species were collected from the Atlantic waters of the Eastern Shore and are new records for that area. Sampling is continuing to fully assess current diversity levels.

- P126 KEZIAH, LANDON K. CHRISTOPHER M. STREET AND C. BRIAN ODOM. Wingate University—Prevalence and distribution of genetic markers in temporally and spatially separated colonies of the Red Imported Fire Ant, *Solenopsis invicta* (Buren).

The Red Imported Fire Ant, *Solenopsis invicta* (Buren), entered the US via the port of Mobile, AL in 1930. In the ensuing years, they have spread rapidly throughout the southeastern states. In the summer of 2006, non-alate (worker) ants were harvested from *Solenopsis* mounds along interstate highways providing samples along north-south and east-west transects. Representative ants from these mounds were examined in terms of several genetic markers. Mound locations were categorized by distances from each other as well as by years post infestation. The prevalence and distribution of genetic markers were correlated by these parameters.

- P127 SANOU, MISSA PATRICK, JENNIFER ZETTER, GREGORY KNOFCZYNSKI AND BILL LEIDERSDORF. Armstrong Atlantic State University—Soil inhabited by fire ants (*Solenopsis invicta*) compared with other soils in relation to plant growth.

Brassica rapa (Fast Plants®) plants developing from seed sown in local soil inhabited by fire ants (I) attained greater height, produced more seed, and had greater dry weights than those sown in soil from abandoned fire ant mounds (A) or from those sown in surrounding soil not colonized by fire ants (S). Results were analyzed by MANOVA, and all differences between I and A and between I and S were significant ($p = <0.001$). Differences between A and S, however, were not statistically significant. The respective per plant mean heights, seed number, and dry weights of plants sown in I were 29.1 cm, 76, and 0.42 g. In contrast, respective mean heights for A and S soils were 9.6 cm and 1.3 cm; seed numbers were 13 and 0; and dry weights were 0.09 g and 0.01 g. Mean yields of plants in commercial potting soil used as controls were substantially higher than those of either I, A, or S (i.e. 34.5 cm, 163, and 2.1 g). Our data support previous reports of localized soil enrichment by fire ants, but based on the low yields of plants sown in A, it appears that these nutritive benefits are ephemeral.

- P128 BASS, CRYSTAL, JENNIFER ZETTLER, AND GREGORY KNOFCZYNSKI. Armstrong Atlantic State University—Temporal effects of red imported fire ants on soil chemistry.

Red imported fire ants, *Solenopsis invicta*, construct dome-shaped mounds that can reach 46 cm in diameter and 46 cm in height. Previous studies have shown that soil from fire ant mounds has different physical and chemical properties than the surrounding soil. To determine how fire ants might alter soil chemistry, we collected soil from five newly formed mounds and tested them monthly using the LaMotte Smart 2 soil testing kit (Chestertown, MD). For controls, we also tested soil from two nearby uninhabited sites. In preliminary trials, we found that, whereas control soils had lower amounts of iron, they had more calcium, phosphate and ammonia nitrogen. Moreover, these trends continue in proportion to the time fire ant mounds are occupied. Therefore, fire ants are capable of changing soil nutrient levels within one week of occupation and more substantially over time.

- P129 DARDIS, DANIELLE R. SUZANNE R. LAZAROWITZ AND VICTOR R. TOWNSEND, JR. Virginia Wesleyan College—Field study of leaf litter activity by cosmetid and sclerosomatid harvestmen in forests along the Northern Coast of Trinidad, W.I.

In the rainforests of northern Trinidad, W.I., harvestmen (Arachnida, Opiliones) are among the most common inhabitants of the forest floor community. However, relatively little is known about the ecology or natural history of most species. In July 2006, we undertook a field study designed to examine diurnal activity of harvestmen within forested habitats along the Northern coast of Trinidad. We randomly selected and sampled 10 plots (1.5 m²) within crappo-cocorite rainforest and 10 plots beneath coconut palm trees adjacent to the beach at Gran Tacarib. Plots were visited twice per day (morning and afternoon) over a three-day period (July 15-17). Harvestmen within a plot were captured by hand, identified using a photographic key, and released. Overall, we observed 100 harvestmen including representatives of three families (Sclerosomatidae, Cosmetidae, and Manaosbiidae). The most common species was *Prionostemma vittatum* (n = 93), but we also observed multiple individuals of *Cynortula* sp. (n = 6). Surprisingly, the vast majority of harvestmen observations occurred under the palm trees (n = 77), with 30 individuals being found during the morning hours and 47 individuals seen in the afternoon. The significance of this habitat for harvestmen is unclear, however, the number of harvestmen per plot appeared to be positively correlated with the presence of coconuts and surface activity was negatively affected by precipitation.

- P130 LAZAROWITZ, SUZANNE R. DANIELLE R. DARDIS AND VICTOR R. TOWNSEND, JR. Virginia Wesleyan College—Mark-recapture study of harvestmen occupying tree trunks in a rainforest in Trinidad, W.I.

Relatively little is known about the natural history or movement patterns of most species of Neotropical harvestmen. In 2005, a field survey of harvestmen in Trinidad, W. I. revealed that several cosmetid and sclerosomatid taxa utilize the surfaces of tree trunks and buttresses as diurnal refuges. However, the residency time of individual harvestmen upon trees was not assessed. In July 2006, we conducted a mark-recapture study of harvestmen that were found on the surfaces of trees in crappo-cocorite forest along the Northern Coast of Trinidad. Individual harvestmen were captured by hand from the surfaces of 24 trees, marked with red or green paint on the dorsum, and released onto the surface of tree upon which they were initially collected. Over the course of a three day period, we marked 91 individuals including 70 *Prionostemma vittatum*, 19 *Cynortula* sp., 1 *Paecilaemainglei*, and 1 *Rhopalocranaus albilineatus* (Manaosbiidae). Perch height (distance above the leaf litter) varied interspecifically. *Prionostemma* were generally

captured at higher perches (mean = 49.8 cm) than *Cynortula* (mean = 5.1 cm). Overall, we observed 3 marked individuals (1 *P. vittatum* and 2 *Cynortula* sp.) upon subsequent visits to the field site (each recapture occurred after 24 hrs). Our data indicate that harvestmen occupying arboreal refuges may be highly mobile. Whether individuals are undertaking vertical migrations or moving between trees requires further study.

P131 HELTSLEY, LAUREN P. DANIEL N. PROUD AND VICTOR R. TOWNSEND, JR.
Virginia Wesleyan College—Behavioral interactions between neotropical harvestmen and potential predators.

The anti-predator defenses of Neotropical harvestmen include a variety of behavioral (immobility), physiological (defensive compounds), and morphological traits (spines). Relatively little is known about the predators of harvestmen in Trinidad. However, there are variety of potential predators, including spiders, toads, mammals, and birds that may prey upon harvestmen. In July 2006, we investigated the interaction of common species of harvestmen (*Prionostemma vittatum*, *Paecilaema inglei*, *Cynortula* sp., *Stygnoplus clavotibialis*, and *Rhopalocranaus albilneatus*) with toads (*Bufo marinus*, n = 6), amblypygids (*Phrynos pulchripes*, n = 7), and a large cranid (*Santinezia serratotibialis*, n = 1). Harvestmen and potential predators were collected by hand from forests adjacent to the beaches at Petite Tacarib and Gran Tacarib and housed individually in plastic shoeboxes. Behavioral trials involved placing a harvestmen in the shoebox of the predator and monitoring the interaction of these species every 60 min over the course of 4 hrs. Over the course of the study, each predator was exposed to at least 4 species of harvestmen in random order. Predation occurred in only six of the 52 trials. In each case, toads were the predators. At least one individual for each species was consumed (with the exception of *Prionostemma* which were ignored by all predators) with no obvious negative affects upon the health of the toad. The invertebrate predators did not interact with the harvestmen in any of the trials.

P132 YODER, JAY A.¹, JACOB T. ARK¹, JOSHUA B. BENOIT² AND ERIC J. RELLINGER¹. Wittenberg University¹ and The Ohio State University²—Characterization of a defense secretion in the red velvet mite.

Balaustium sp. (Ohio, undescribed) are tiny, rapidly crawling, brightly colored red mites that appear in landscape each spring, covering plants and concrete foundations. Their importance relates as potential biological control agents against scale insects and phytophagous mites. They are noted for having an unusual pair of structures on the dorsum called urnulae, claimed to be an extra set of eyes. Here we show that urnulae have a secretory function, projecting as a pair of tubercles and releasing a stream of red fluid at the tip when the mite is threatened. Consistent with a defensive role for these organules are that: (1) urnulae are exocrine glands, featuring secretory granules, innervated muscle, and glandular tissue when examined by scanning electron microscopy, histochemical and ammoniacal silver nitrate staining; (2) application of urnulae secretion conveyed protection and resulted in > 70% reduction in ant attacks on treated mealworm larvae in standard ant-beetle predation bioassays; and (3) exposure to urnulae secretion prompts conspecific mites to undergo an excited dispersal response, indicating that this secretion functions dually as an alarm pheromone that is a common parsimony for majority of defense secretions. More pronounced repellency in defense and alarm tests was noted in response to extracted mite body fluids, implying that the activity of the urnulae secretion parallels that of mite hemolymph. Thus, the mechanism appears to operate by a novel form of reflex bleeding that links defense, unpalatability, with aposematic (warning) coloration, not unlike that in certain beetles.

- P133 BARTELS, P.J.¹ AND DIANE R. NELSON². Warren Wilson College¹ and East Tennessee State University²—An electronic field guide and key to the tardigrades of the Great Smoky Mountains National Park.

Taxonomic keys to the tardigrades are almost exclusively text-based, and non-pictorial. Additionally, they are scattered among obscure and difficult to find publications, and many are outdated due to the upsurge in publications of new species descriptions in the past 10 years. Updated, user-friendly, pictorial, web-based keys would be useful for people new to tardigrade taxonomy and experts alike. Several computer-based software programs now exist for developing pictorial, multichotomous (or non-linear) keys. We used Lucid 3.3 (www.lucidcentral.com) developed by the Centre for Biological Information Technology at the University of Queensland, Australia to develop a key for the tardigrades found during our inventory of the Great Smoky Mountains National Park. To date, this includes 70 species. In addition to the key itself, Lucid allows the attachment of photomicrographs, species accounts, and range maps, thus providing a complete electronic field guide. A laptop computer running our key and field guide will be available at the poster session. The poster will include complete instructions and some photographic enlargements of specimens to use with the software.

- P134 COHEN I. AND J. SHAW. University of Tennessee, Chattanooga—A preliminary floristic survey of the Grant Tract of the Tennessee River Gorge Trust, Marion County, Tennessee.

A preliminary floristic survey of the vascular flora of the Grant Tract in Marion County, Tennessee was conducted to document species richness of newly acquired land by the Tennessee River Gorge Trust. The Property encompasses approximately 800 Acres on Aetna Mountain; which is on the south side of the Tennessee River in Southeast Tennessee. The Tennessee River Gorge is the fourth largest river canyon east of the Mississippi River. The preliminary survey yielded 75 species in 37 families and 59 genera.

- P135 HUSKINS, STACY AND JOEY SHAW. University of Tennessee at Chattanooga—A preliminary flora of the North Chickamauga Creek Gorge State Natural Area.

The North Chickamauga Creek Gorge State Natural Area (NCCG) consists of 4,864 acres and is located in Hamilton and Sequatchie counties in eastern Tennessee. The NCCG is on the eastern edge of the Cumberland Plateau and is bordered by the Ridge and Valley physiographic province. Broadly defined habitat types support a diverse assemblage of plants on the NCCG's upper plateau surface, gorge slopes, stream banks, and ruderal areas. Floras of nearby areas comprised of similar habitat types have reported over 1,000 species. Ten species with either a state or federal listing are known to occur in the NCCG: *Scutellaria montana*, *Spiraea virginiana*, *Nestronia umbellula*, *Phemeranthus mengesii*, *Sabatia capitata*, *Diervilla sessilifolia* var. *rivularis*, *Lonicera dioica*, *Panax quinquefolius*, *Viola tripartita* and *Glyceria acutifolia*. Twenty collecting trips were made during the spring and early summer of 2006 and 180 species of vascular plants in 72 families were documented, including several populations of *Scutellaria montana*.

BETA BETA BETA ABSTRACTS

Paper and poster presentations at the Fiftieth Annual Meeting
held with the Association of Southeastern Biologists,
April 18-21, 2007, Columbia, South Carolina

**Paper Presentations
Southeastern District I, Section 1**

Garcia, Veronica. Sigma Phi, Guilford College and The Whitney Laboratory for Marine Bioscience—The search for TRPN in *Cyanea capillata* and *Nematostella vectensis*.

The phylum Cnidaria is made up of four main classes of organisms including Scyphozoa and Hydrozoa. All organisms within the phylum Cnidaria contain sting cells commonly referred to as cnidocytes, which the organisms use for prey capture, defense, locomotion or attachment. The discharge of a cnidocyte requires two forms of stimuli, chemosensation and mechanosensation. It is hypothesized that the mechanosensory stimulus is facilitated by a cation channel belonging to the transient receptor potential (TRP) protein family, specifically the subfamily TRPN. Using known TRP DNA and amino acid sequences, primers were developed to bind to a 70 base pair fragment of a conserved region in the DNA sequence. Cloned DNA libraries of *Cyanea capillata* and a whole DNA sample of *Nematostella vectensis* were used as templates in the search. With the use of basic molecular methods including polymerase chain reaction and cloning, a 75 base pair fragment bearing high homology to the NompC protein in *Apis mellifera* was found in the whole DNA of *N. vectensis*. Further research will potentially lead to recovering the entire TRPN DNA sequence of *N. vectensis*, which could then be used as a more conserved template for developing primers to recover TRP sequences in other Cnidarians.

Brown, Sarah & Lisa Kelly. Psi Lambda, University of North Carolina at Pembroke. Preliminary population study of *Chrysoma pauciflosculosa*: A North Carolina state endangered plant.

Chrysoma pauciflosculosa is a state endangered shrub in North Carolina, its range limited to three counties. Four subpopulations of *C. pauciflosculosa* on Big Sandy Ridge (Columbus County, NC) were surveyed in transects (two at 1 x 25 m, one at 1 x 24 m, and one at 1 x 19 m) in fall 2005. All plants in seven size classes (0-2, 2-5, 5-10, 10-20, 20-30, 30-40, and ≥ 40 cm) were counted in 1-m² plots throughout the transects. In spring 2006, the two longest transects were resurveyed; all cotyledon-bearing seedlings were counted in one transect. Seeds were collected from three subpopulations in October 2005. Preliminary germination tests were later performed in ambient room conditions and in a 24⁰C tissue culture chamber. Population density in the fall ranged from a mean of 0.2 plants/m² (≥ 40 cm size) to 3.5 plants/m² (0-2 cm size); the four smallest size classes had a clumped dispersion pattern and the three largest classes had random dispersion. Germination in the spring recruited many plants to the 0-2 cm size class, averaging 6.4 seedlings/m². Proportionally fewer seeds germinated inside the culture chamber versus in ambient conditions. Seed germination may not limit population size on Big Sandy Ridge. (Funding provided by the Beta Beta Beta Research Scholarship Foundation.)

Meserve, Margaret M. Sigma Phi, Guilford College. Social Context of the Behavior and Vocalizations of the California Gray Whale (*Eschrichtius robustus*).

Behaviors and vocalizations of gray whale mother-calf pairs and non-mother-calf groups were investigated in Bahia Magdalena, Mexico to determine whether gray whale mother-calf pair behaviors affect the behavior and vocalizations of non-mother-calf groups. Background research of California gray whale behavior and vocalizations was used to link the results of this research to the results of previous studies. Fifteen-minute sessions of behavioral observations and acoustic recordings of gray whales in various social contexts were collected (February-April 2006; n=30). The Cool Edit ® program was used for analysis of sound production. Full length acoustic tracks with mother-calf pairs as well as non-mother-calf groups were examined in order to identify possible vocalizations. Acoustic and behavior times were correlated to see if any gray whale vocalizations and behaviors could be linked. Preliminary acoustic analysis found no correlation with social contexts or behaviors. Behavioral results indicate significance in frequencies of traveling behaviors ($\chi^2=5.09$) of groups with mother-calves. Correlations between social context and use of sounds could allow acoustics to be an indicator of group composition, migration, social patterns and help to determine the functions of sounds.

Sherrill, Laura Willard. Sigma Phi, Guilford College. Evidence For Programmed Cell Death in the Spinal Interneurons of the Chick Embryo.

Programmed cell death (PCD), the normal, target-regulated loss of large numbers of cells during development (Oppenheim, 1999) is evident in the developing nervous system of most vertebrates. This mechanism selects innervating neurons through competition for trophic factors. The domestic chicken, *Gallus gallus*, provides a useful animal model for the study of PCD *in vivo*. While programmed cell death occurs in large scale among most neuronal populations, the lumbar spinal interneurons of the chick have previously been reported not to undergo PCD (McKay and Oppenheim, 1991). However, in 1997, PCD was found to occur in lumbar interneurons of the postnatal rat (Lawson et al, 1997). The rat study utilized TUNEL staining, which identifies cells undergoing apoptosis by staining degrading DNA, while the chick study used Nissl-staining, an all-purpose histological stain that labels basophilic components of the cytoplasm, the endoplasmic reticulum (ER), as well as the nucleus, that both undergo degenerative changes during PCD. This study reevaluates the extent to which PCD occurs within the interneurons of the lumbar spinal cord of the chick embryo utilizing TUNEL staining. Preliminary results indicate PCD is present in the interneurons of the chick embryo.

Kinsley, Kody H. Rho Pi, Brevard College. Secondhand smoke and air quality in Brevard, NC, restaurants.

Secondhand smoke is a toxic substance attributed with nearly 53,000 American deaths annually. For the past several decades, various public health initiatives have attempted to prevent unnecessary exposure to secondhand smoke through education and regulations. Brevard, NC, is a small mountain town with a strong tourist-based economy. Eateries in the town have adopted various policies of their own, without direction from a governmental body. This study is aimed at weighing the effectiveness of those policies and measuring the levels of exposure to secondhand smoke within the restaurants.

Cirilo, Stephanie R.*, Nora R. Espinoza, Megan E. Pruette, Katherine M. Wright, J. Stephen Gosnell, Michael T. Butcher, and Richard W. Blob. Sigma Gamma, Erskine College. Limb Bone Strain Rates across Diverse Locomotor Modes: Hopping, Jumping and Walking.

Previous studies have found that when bones are exposed to higher rates of strain during loading, they can endure greater strain magnitudes before yield failure. Previously, we evaluated how differences in strain rate might affect load bearing in emydid turtles and ranid frogs, species that use different modes of locomotion. In a continuation of this study,

we examined a bufonid frog, the marine toad *Bufo marinus*, which moves using short hops rather than the long jumps of ranid frogs. Given this difference in locomotor style, we expected strain rates for any given strain magnitude in bufonids to be smaller than those in ranids, but greater than those in turtles. Strain rates were collected *in vivo* from strain gages implanted on the right femur of multiple animals. Raw strain values and high-speed video were collected simultaneously as the animals traveled across a treadmill. Extracted strain rates positively correlated with strain magnitudes in each species. Contrary to expectations, we found that, for any given magnitude measured in bufonids, bufonids had strain rates greater than or equal to ranids, but greater than emydids. This may be related to bufonids having shorter limbs than ranids, and thus developing the same magnitude of strain over a truncated time period. These differences in strain rate could contribute to differences in load bearing capacities of limb bones both across and within these lineages.

Quintero-Varca, Tatiana. Tau Xi, Meredith College. Expression and Biochemical Characterization of *Pyrococcus horikoshii* Prolidase Homolog 1 for Potential use in Organophosphorous Nerve Agent Detoxification.

The enzyme prolidase is a proline dipeptidase, which cleaves dipeptides having proline as the C-terminal residue. Prolidase has also been reported to hydrolyze the model organophosphorus (OP) nerve agent diisopropylfluorophosphate (DFP). The prolidase from the hyperthermophilic archaeon, *Pyrococcus furiosus*, has been biochemically and structurally characterized. The potential use of *Pyrococcus furiosus* prolidase for detoxification of OP nerve agents is particularly attractive due to its extreme thermostability; however, its cobalt-dependence for activity and low activity at temperatures below 50 °C currently limit its utility in OP nerve agent detoxification. Recently it was determined that the hyperthermophilic archaeon *Pyrococcus horikoshii* has a prolidase gene equivalent to the previously characterized *P. furiosus* prolidase as well as two other prolidase homolog genes. For future evaluation of the use of *P. horikoshii* prolidase homolog 1 (55% similar to *P. furiosus* prolidase) for detoxification of OP nerve agents, this gene was cloned into the T7 RNA polymerase-based expression vector pET 21b. Over-expression of the *P. horikoshii* prolidase homolog 1 protein in *E. coli* strain BL21(λDE3) was evaluated in small scale expression experiments using both LB and autoinduction media. Thermostability and activity studies were conducted using the recombinant *P. horikoshii* prolidase homolog 1. It was determined that the protein was thermostable and that it had significant activity when cobalt is present in the reaction mixture and when the dipeptide Methionine-Proline is used as the substrate.

* Munoz, Angela. Beta Eta, Florida Southern University. A Quantitative Study on the Distribution of the Channeled Apple Snail *Pomacea Canaliculata* in a Central Florida Lake

The purpose of this study is to simultaneously determine the distribution of *Pomacea canaliculata* and the association between water temperatures and number of egg casings. This study is aimed at determining how the species *Pomacea canaliculata* spreads from one lake to another, how rapidly it invades a lake, and how to prevent the distribution into Southern Landing. *P. canaliculata*, more commonly referred to as the Channeled Apple Snail (CAS), made its way from South America to Florida in 1978. This species is of great concern because of the damaging ecological effects it has on lake habitats. Data was collected from Lake Hollingsworth on monthly intervals since January 2006 for evidence of CAS. Evidence verification was in the form of egg casings, shells, and the snail it self. Results have indicated a strong association between water temperature and the number of egg casings. The data analysis illustrates a fluctuation in the population of CAS. When comparing this year's data with the previous there is evidence of a dramatic decrease in the rate of spread of the snail perhaps indicating that the snail has occupied all suitable habitats.

Ross, Brittany J. Tau Xi, Meredith College. Drought responses in plants—the role of a lipid-transfer protein.

Agricultural productivity today is primarily hindered due to the lack of fresh water. This problem could be managed if crop plants were bred to be more tolerant to drought. The first step in this process is to understand the complex ways in which plants respond to drought. When a plant is subjected to drought stress, genes encoding a remarkable array of proteins are turned on or off. One such protein, AtSsh1p transports phospholipids required by cellular membranes. AtSsh1p can also regulate lipid metabolism, and may have a critical role in controlling membrane dynamics and signaling during periods of water deficit. Here, we explore the physiological role of AtSsh1p, especially in drought-responses. For this study, we used T-DNA insertion mutants of the model plant *Arabidopsis thaliana*. In these mutants, a large piece of DNA (T-DNA) has been used to disrupt the AtSsh1 gene. Therefore, no AtSsh1 transcript or protein is made. By analyzing these mutants by growing them in media with varying levels of salinity, we can identify specific aspects of plant responses to drought that are controlled by AtSsh1p. This understanding can then be applied to crop plants, and may help us breed drought-resistant plants to improve agricultural productivity.

***Frank J. Brooks Paper Award Winner Southeastern District I, Section 1**

Paper Presentations Southeastern District I, Section 2

Boyer, Lyssa M. Sigma Psi, Florida Institute of Technology. Study of Soybean Lipooxygenase Type-1 under non-physiological conditions.

The study of Soybean Lipooxygenase Type-1 (SBLO-1) under non-physiological conditions may allow insight into its mechanism of action. Lipooxygenases are ubiquitous oxidative enzymes that can be found throughout the animal and plant kingdoms. Although SBLO-1 has been studied extensively, little has been done under non-physiological conditions with unnatural substrates, which could provide important new information for synthetic chemistry involving SBLO-1. This study examines the ability of SBLO-1 to oxidize monoolefins under hyperbaric conditions. Rather than forming the expected hydroperoxide products, α and β unsaturated enones are formed. To gather evidence of a possible allylic hydroperoxide intermediate, Tin (II) and Germanium (II) were used as in situ reducing agents. The result was formation of allylic alcohols. Because Tin (II) and Germanium (II) can not reduce enones, the resulting allylic alcohols support a hydroperoxide intermediate. This previously undiscovered enzyme biochemistry gives insight into how SBLO-1 reacts with unnatural substrates, and provides a foundation for new synthetic applications.

Bauer, Caroline. Sigma Psi, Florida Institute of Technology. Retinal form and function in juvenile tarpon (*Megalops atlanticus*)

The teleost fish subdivision Elopomorpha includes tarpon (*Megalops atlanticus*), bonefish (*Albula vulpes*), ladyfish (*Elops saurus*), and a variety of eels. These species share a unique larval form called the leptocephalus, but undergo incredible diversification in morphology, behavior, and habitat as they mature. I hypothesize that elopomorphs also undergo dramatic changes in retinal anatomy and function in support of habitat and behavioral changes. Vision is almost completely unexplored in elopomorph fishes, so I began by examining the distribution and function of retinal photoreceptors in juvenile tarpon. Frozen cross sections and tangential sections of retina were immunohistochemically labeled using anti-rod and anti-cone opsin antisera, followed by fluorescently-labeled secondary antisera. Distributions of rods and cones across the retina

were also examined in whole mounts. The results show that (1) tarpon retinas contain immunologically-distinct rods and cones, (2) rods occur in large bundles interspersed among single cones, (3) rods are much more abundant than cones in ventral retina, (4) cones are more abundant than rods in dorsal retina, and (5) photoreceptor outer segments undergo dramatic retinomotor movements. These results show that retinal anatomy/function supports the active diurnal and nocturnal predatory behaviors that tarpon develop after metamorphosing from leptocephali to juveniles.

King, Ryan. Florida Institute of Technology. High-speed videography demonstrates adaptive significance of infrared imaging by pitvipers, boas and pythons.

Boas, pythons, and pitvipers utilize a novel infrared imaging system to accurately target homeothermic prey and potential predators. This system operates on the basis of thermal contrast, and promotes accurate strikes even in darkness. To test the hypothesis that infrared imaging promotes different behavior in these snakes vs. other species, predatory strikes by pythons, boas and kingsnakes (*Lampropeltis getula*, a non-infrared imaging species) were monitored by high-speed videography. Normal snakes and congenitally anophthalmic (monocular) snakes were tested with and without visual input (in some trials, snakes were blindfolded). Strikes were quantified according to location on prey- head, upper body, abdomen, or hind quarters. Results show that infrared-imaging snakes preferentially targeted the upper body region, while strikes by non-infrared-imaging snakes were more scattered, often landing on the abdomen and/or hind quarters. These results indicate that the infrared imaging system promotes accurate targeting to an area of high thermal signature, and an area that more likely results in successful prey capture. Thus, one adaptive advantage of infrared imaging may be that snakes with this system are more successful at targeting homeothermic prey than those species without.

Banks, April B. Rho Pi, Brevard College. Hands-on versus hands-off: A study in the effectiveness of experiential versus traditional learning in environmental education.

As the need for environmental education is growing, studies are needed to show the most effective methods of teaching for short and longer term learning. After holding a community workshop to observe the effects of hands-on active methods of education, I designed a more rigorous study to focus on methods of traditional/literary and lecture styles versus methods of non-traditional/active hands-on experiential education. I led a series of environmental education workshop sessions to children ages seven through seventeen. The sessions either consisted of a hands-on, active participation session or a traditional lecture session that also utilized literary resources. I collected pre- and post-workshop data to evaluate the effectiveness of these two methods on environmental learning in these children. No significant differences were found in this study between the two workshop sessions. In striving to tie environmental education to the most effective means of learning impact in children, the results suggest that both methods need to be studied further before assuming that one method of education is necessarily more effective than another in all cases.

Rosen, Joshua J. Rho Pi, Brevard College. Notes on the behavior and distribution of *Phausis reticulata* (Blue Ghost Firefly).

Phausis reticulata is a poorly known firefly found in the southern Appalachians, usually observed from late April to mid-July, depending on elevation and latitude. *P. reticulata* is distinct from other lampyrids found in the region in that its luminescence is characterized by a steady glow, in contrast to a species-specific pattern of flashes. The species is also characterized by a large degree of sexual dimorphism, with a winged male and larviform

female. The behavior and habitat of *P. reticulata* were studied at several locations during May and June 2006. Collection information was also gathered from preserved specimens in insect museums. The distribution of *P. reticulata* was confirmed to be centered in the southern Appalachians. Observations of male behavior supported those of J.E. Lloyd, while observations of female behavior differed.

Braden, Amy. Tau Xi, Meredith College. Elucidation of the Mechanism of Activation of a Protein Kinase.

Soybean Protein Kinase-1 (SPK1) is a 339 amino acid enzyme important to drought response in some plants. When a plant cell is subjected to osmotic stress, SPK1 is activated. Active SPK1 phosphorylates a phospholipid transfer protein and triggers cellular responses leading to alterations in phospholipid metabolism. The goal of this project is to determine the mechanism of activation of SPK1. The mechanism of activation is unknown but since it has been shown that similar drought responsive proteins are activated by C-terminal truncations, we hypothesize that by deleting amino acids off the C-terminal end of the protein sequence in one of four places, we will be able to produce a protein that is constitutively active, and thus determine the mechanism of activation. By site-directed mutagenesis PCR, we have generated three SPK1 gene constructs encoding premature stop codons, and transformed yeast cells with these gene constructs (the SPK1 activation pathway can be reconstituted in yeast). These SPK1-expressing yeast cells were subjected to hyperosmotic stress. Currently, we are assessing protein extracts from hyperosmotically stressed and unstressed yeast cells for SPK1 activity. The results of these experiments will be presented

*Lammons, M. Louise. Beta Rho, Wake Forest University. Particle Processing on the Mantle of the Freshwater Mussel *Utterbackia imbecillis*

Suspension feeding in bivalve mollusks includes both particles which are ingested and those that are rejected as pseudofeces. This study was designed to discern the pattern of particle processing on the mantle of the mussel *U. imbecillis*. Half-shell preparations of fresh mussel tissue were used to observe the movement of graphite particles with a video camera. Scanning electron microscopy (SEM) was used to determine the nature and distribution of cilia and ciliary tracks on the mantle surface. Particle transport occurred along two major dorsal tracks, one immediately adjacent to the gill-mantle junction, and another parallel and ventral to the first. The two tracks converge on the labial palps and are densely covered in long cilia, while the area between the tracks is less heavily ciliated. Ventral to both tracks, the cilia are clustered into discrete tufts, and particles that impact the mantle in this region are shunted to the mantle margin and ejected as pseudofeces. It was apparent in the fresh preparations that mucus production is involved in compacting and transporting particles. A general understanding of the mechanisms for particle transport might allow for the determination of species-specific efficiencies in dealing with such issues as sedimentation and gas exchange.

Jones, Kristian D., Dr. Jennifer Cruse-Sanders and Dr. Traci Porter. Beta Alpha. Salem College—Comparison of fruit production by *Stenocereus stellatus* (Cactaceae) in wild, managed *in situ*, and cultivated populations of the Tehuacan Valley in Central Mexico.

Stenocereus stellatus is an ecologically and economically important columnar cactus species endemic to the Tehuacan Valley in Central Mexico. It is managed by people for fruit production in cultivated, managed *in situ* and wild populations. To understand how management affects fruit production, densities of flowers, fruits and floral buds, *S. stellatus* were estimated for seven populations (3 wild, 2 managed *in situ*, 2 cultivated). Fruit production was equally great in one managed and in one wild population. Among all

populations fruit densities were not correlated with densities of floral buds and flowers. There was a positive relationship between number of fruits per population and the number of reproductive arms per population. Management that enhances branching and production of reproductive arms in populations *S. stellatus* could lead to greater fruit production.

Campbell, Ashley. Sigma Phi, Guilford College—Habitat preference of Nassau Grouper, *Epinephelus striatus*, around South Caicos, Turks and Caicos Islands.

Nassau grouper, *Epinephelus striatus*, a heavily exploited species, is considered endangered throughout its range (Caribbean to Western Atlantic) making it a management priority. Effective management of this species requires a sound understanding of its ecology. This study assesses the habitat preference of *E. striatus* around South Caicos, Turks and Caicos Islands, British West Indies. Data sets were collected on the length, precise locations (global positioning system, GPS), and habitat types on both a fine scale (precise structures: e.g. ledges, sponges) and broad scale (general habitat type: e.g. seagrass, patch reef) of the grouper, by transects performed by snorkel and tracked by GPS over a variety of habitat types spanning from the shallow sand plains of the harbor to the reef drop-off. *E. striatus* were not found to inhabit areas that lack topographical complexity. They were found in habitats that included protective characteristics such as ledges, corals, large sponges, large gorgonian soft corals, blowouts, and artificial structures. *E. striatus* were commonly observed not hidden high topographically complex ecological systems. This preliminary data implies that *E. striatus* habitat includes areas that have an abundance of available protective structures.

***Frank J. Brooks Paper Award Winner Southeastern District I, Section 2**

Paper Presentations Southeastern District II

Eklund, Lauren N. Mu Omicron, Columbus State University. Analysis of the flavonolignans from extracts of various brands of commercial milk thistle (*Silybum marianum*) supplements.

The herbal supplement, milk thistle (*Silybum marianum*), contains flavonolignans that possess therapeutic abilities. There are four major flavonolignans, silybin, isosilybin, silychristin, and silydianin. The flavonolignans are collectively referred to as silymarin. Silybin A and silybin B are the most active flavonolignans. As with all herbal supplements, this product is not regulated by the Federal Drug Administration. The true amount of flavonolignans in the commercial products is unknown. Using a high-performance liquid chromatography (HPLC) method, developed by the Institute for Nutraceutical Advancement, silymarin flavonolignans from six commercial milk thistle products were analyzed. Standard solutions of silybin (A and B) were used to create a calibration curve. Using this calibration curve, the amount of each flavonolignan in the commercial extracts was quantified. Peachtree Natural Foods milk thistle contains the highest concentration per capsule of active flavonolignans, silybin A and B; however it also shows the greatest deviation from the amount of silymarin stated on the bottle. Overall, the six commercial supplements consistently show lower amounts of silymarin compared to the bottle, with Natures Resource showing the least deviation. Based on a cost analysis, Origin capsules, purchased from Target, contain the highest concentration of silybin A and B for the lowest price.

Ker-Fox, Wesley. Mu Omicron, Columbus State University. Role of brain apelin in ACE2 gene expression and the control of blood pressure in normotensive rats.

Aberrant signaling of the brain and endocrine renin-angiotensin systems (RAS) is linked to development of hypertension and cardiovascular diseases; however, the molecular mechanisms involved are not fully understood. Previous research revealed an increased central expression of apelin, a protein similar to angiotensin II, in hypertensive rats. This study tested the effect of apelin on angiotensin-converting enzyme 2 (ACE2) mRNA expression *in vitro*. Primary astrocyte cell cultures from the hypothalamus and brain stem of one-day-old WKY rats were treated with PBS, 10^{-7} M or 10^{-6} M concentrations of apelin for 4 or 24 hours, followed by mRNA isolation. This mRNA was amplified and reverse transcribed into cDNA. The cDNA was amplified using real time RT-PCR and primer/probe sets specific for ACE2 (target) and 18s (control). The 4 and 24 hour groups showed no significant change in ACE2 mRNA expression thus was not concentration dependent. Taken together, the results from this study indicate that apelin caused an insignificant increase in ACE2 mRNA expression. These results contradict previous studies; therefore, questions remain as to the role of apelin in the central control of hypertension.

Bergren, Amanda L. Mu Omnicron, Columbus State University. A Suppressor Screen to Identify Downstream Effectors of the Mob2/Cbk1 Pathway that Interact with Ras2.

The *Saccharomyces cerevisiae* *MOB2* gene is a component of the RAM signaling network which is important for cell morphogenesis. *RAS2* is a small monomeric GTPase that stimulates the production of cyclic AMP, which in turn activates protein kinase A (PKA). Activate PKA phosphorylates numerous targets to initiate cell growth. Deletion of *RAS2* (*ras2Δ*) alone does not affect cell growth; however a slow growth phenotype due to a G1 delay occurs in strains containing deletions in both *RAS2* and *MOB2*. This phenomenon, in which a phenotype is not observed when single genes are mutated, but only when the two mutations occur in the same cell, is known as a synthetic genetic interaction and is indicative of the genes functioning in parallel pathways. Over-expression of PKA suppresses this defect. In the current study, a genetic screen for high-copy suppressors of the *ras2Δ mob2Δ* synthetic slow-growth phenotype was performed to identify novel downstream targets of *RAS2* and RAM signaling. Several potential suppressors have been isolated. We also found that over-expression of known downstream targets of the RAM network, *SIM1*, *CCW12*, *SRL1*, *CBP3* and *ZRG8*, did not suppress the *ras2Δ mob2Δ* slow-growth phenotype, suggesting that the affected downstream targets have yet to be revealed.

Reddoch, Leah. Mu Chi, Midway College. Relationship of neonatal thoroughbred foals immunoglobulin G levels, total serum protein levels, packed cell volume, whole blood glucose, and total white blood cell count to survival at seven days in central Kentucky equine hospital.

Many factors affect the neonatal Thoroughbred foal during the first few hours of life. It is vitally important that the foal receives adequate colostrum and milk from the mare within 12 hours. The purpose of this research is to determine a relationship, if it exists, between immunoglobulin G (IgG) levels, packed cell volume (PCV), total protein (TP) levels, whole blood glucose, or white blood cell (WBC) count upon admission of a foal no older than 24 hours and survival at seven days. As foals were admitted to the hospital, blood was sampled via a jugular catheter and analyzed using light spectrometry for whole blood glucose and IgG, with the AcT diff hematology method being used for white cell count, total serum protein, and packed cell volume. Survival was determined by owner contact if the foals were released from the hospital prior to seven days of age. After statistical analysis using the chi-square, it was found that there was a positive association between white cell count upon admission and survival at seven days. Comparison of packed cell

volume, total protein, glucose, and IgG to survival at seven days determined that these factors were independent of each other.

Johnson, Lakesha¹, Pushpa Samkuty¹ & William Doerrler² Eta Mu Southern University-Baton Rouge and Louisiana State University². Analysis of Outer Membrane Protein Biogenesis in an *E. coli* Mutant Defective in Lipid Export.

The analysis of outer membrane protein biogenesis in an *E.coli* mutant defective in lipid transport was the focal point of this study. Following biosynthesis in the cytoplasm, proteins destined for the *E.coli* outer membrane (OM) are transported across the inner membrane (IM) by the Sec machinery. Once in the periplasm, they are folded into their correct three dimensional structures by a number of molecular chaperones. This folding has been reported to require lipopolysaccharide for a number of OM proteins, including OmpA. Here, we present data on the folding of OmpA in a temperature-sensitive mutant of *msbA* which is defective for export of LPS under nonpermissive conditions. W3110 (wild type) and WD2 (*MsbA* mutant) were grown at both permissive (30°C) and nonpermissive (44°C) and analyzed using a western blot technique and an immunoprecipitation protocol. We found that there is no detectable increase in unfolded OmpA in *msbA* mutant WD2 during growth under nonpermissive conditions

Rhorer, Jamie. Mu Chi, Midway College. Comparison of antibiotic susceptibility profiles of *Escherchia coli* isolated from horses, cattle and humans in central Kentucky.

Fecal contamination of our waterways is a major environmental concern worldwide. Not knowing the source of contamination poses a significant threat for people who come in primary contact with the water. Three possible sources of fecal pollution in central Kentucky include: horses, humans, and cows. Fresh fecal samples were collected from humans, horses, and cows and were placed in sterile transport media. Fecal samples were plated to MacConkey agar and incubated at 37° C for 24 hours. Seventeen cow isolates, eighteen horse isolates, and seventeen human isolates were identified as *Escherichia coli* using Enterotube II and conventional biochemicals. Antibiotic susceptibility patterns from the Kirby Bauer test reveal that ampicillin and streptomycin paired with amoxicillin and ciprofloxacin may be useful in determining the source of contamination.

Harris, Amanda. Mu Chi, Midway College. The Use of Antibiotic Susceptibility Patterns to Distinguish Between Horse, Cattle, and Human Sources of *Escherichia coli* Found in Central Kentucky Streams.

Fecal coliform contamination is a major threat to water quality in central Kentucky watersheds. Fecal contamination is widespread and may cause illness in humans. Methods for controlling fecal contamination, like Antibiotic Susceptibility testing, are being explored to help control the problem. During the fall of 2006, 15 duplicate samples were collected from various central Kentucky streams. *E.coli* was identified in 46.7% of samples, while 100% of samples demonstrated excessive amounts of lactose fermenting fecal contaminants. Antibiotic Susceptibility testing was performed on *E. coli* isolates using the Kirby-Bauer Disc Diffusion Method, then compared to the Midway College library of known susceptibility profiles for central Kentucky horse, cattle, and human *E. coli*. The antibiotics amoxicillin, streptomycin, and gentamycin seemed effective in allowing possible identification of the contaminants' source in 57% of all *E. coli* isolates, and it was noted that ciproflaxin may be useful to future studies. Sources could not be positively identified due to limited sample size, but did frequently show susceptibility patterns that were suggestive of the source.

*Banks, Eric D. Mu Iota, Northern Kentucky University. Biogeochemical Influences on the Precipitation and Dissolution of Calcium Carbonate in Hypogean Cave Environments.

In order to investigate whether active metabolic microbial processes dominate over passive geochemistry in the formation of calcite polymorphs, we are examining calcium carbonate (CaCO_3) precipitation and dissolution from hypogean cave environments. Microbial species were isolated from CaCO_3 'popcorn' deposits within Grayson-Gunnar Cave, Kentucky, based on their ability to deposit CaCO_3 crystals on Boquet-B4 media or to dissolve calcite in a CaCO_3 enriched 'top' agar. Examination of the crystal structure produced by these precipitating species using scanning electron microscopy demonstrates bacterial-like footprints in, and on, the surface of these crystals. These data have shown the same species can precipitate various mineral forms of CaCO_3 , including calcite, vaterite and aragonite. By correlating the structure of the CaCO_3 crystals with environmental growth conditions of individual species using powder x-ray diffraction (XRD), we hope to correlate microbial metabolic activities with CaCO_3 precipitation. By studying the conditions that similarly allow such species to dissolve CaCO_3 including organic acid production, we hope to better understand the role that CaCO_3 plays in cellular buffering during growth. Together such results should provide clues to the metabolic and environmental drivers that promote CaCO_3 precipitation and dissolution reactions in such hypogean cave environments.

Nwosu-Abanum, Uchechi, Amjad Nasir, Popoh Atairu, and John Hisey, Sigma Omega, Lee University. Group structured genetics in a solitary carnivore.

Both group-living and solitary mammalian species often violate the assumptions of the generally used island model of population genetics by displaying non-random mating and sexual differences in dispersal. Variations in these two factors are accommodated by recent models which incorporate clusters of kin and have been applied to the group-living, but not the solitary mammalian species, which are more abundant. Raccoon data supports our hypothesis that solitary mammals may commonly display kin-clustered genetics. The degree of genetic differentiation among female kin clusters and the departure from random breeding of individuals within a kin cluster appear to be substantial and to vary with measures not incorporated into the island model. These outcomes are similar in magnitude to those for more social species and are greater than the equivalent measures for larger groups of raccoons. Genetic structure of groups should be analyzed at the smallest scale at which nonrandom dispersion is detected.

***Frank J. Brooks Paper Award Winner Southeastern District II**

Poster Presentations Southeastern District I

Woodbine, Karlene. Sigma Phi Chapter, Guilford College. Generation of Specific Antibody Targeting the Niacin Receptor

Niacin is one of the most powerful available drugs for reducing high cholesterol levels that lead to the progression of cardiovascular disease. Pharmacological doses of niacin induce beneficial changes in serum lipids, particularly HDL-C. In addition to raising HDL-C, niacin lowers the level of VLDL and LDL by acting on adipose tissues to inhibit the breakdown and mobilization of free fatty acids. As a result, the circulation of plasma cholesterol and free fatty acids is reduced, decreasing mortality from cardiovascular diseases. Adipocytes express a G-coupled receptor with a high affinity for niacin. It is presumed that changes in HDL-C upon niacin therapy are mediated via the niacin receptor. Despite intensive efforts by the pharmaceutical industry, limited antibodies have yet been produced targeting the receptor. As a result, basic biological approaches, such as immunological assessment of tissue-specific expression of the niacin receptor, remain out of reach. Rabbit antibodies have been raised that target peptides derived from the primary sequence of the niacin receptor. Western blots containing human and mouse receptor proteins have been probed to test the specificity of the rabbit sera. So far, four different serum lots from four different animals have been identified that react specifically with this protein.

Phillips, Roslyn J. Sigma Phi, Guilford College—Minority Health International Research Training, Argentina. Outbreak of *Staphylococcus aureus* isolates containing the *lnuA* gene in the neonatal unit of Hospital Evita Lanus City, Argentina

Macrolides, lincosamides, and streptogramins are three groups of antibiotics that have similar modes of action; they bind to the 23S rRNA and interfere with translation. Macrolides are composed of two or more amino or neutral sugars linked to a 14-26 member lactone ring. Lincosamides are clindomycin alkyl derivatives of proline. Streptogramins are composed of two compounds that work synergistically. MLS (Macrolide, Lincosamide, and Streptogramin) phenotype is cross-resistance to these three groups of antibiotics. Bacterial isolates that contain MLS phenotype synthesize an enzyme that dimethylates the 23S rRNA. In *Staphylococcus aureus*, the genes *ermA*, *ermB*, and *ermC* confer MLS resistance. In contrast to the MLS triple resistance, resistance to lincosamide alone is due to drug modification. The enzyme lincosamide nucleotidyltransferase, that inactivates the lincosamide drug, is encoded for by the gene *lnuA*. Nucleotidyltransferase modifies the drug by adding methyl groups to hydroxyl groups at position 4 of lincosamide. This research describes clinical isolates of *S. aureus* collected from patients and hospital workers in Hospital Evita, located in Lanus city, Argentina. It was confirmed that all strains are phelogenetically related, in that the strains contained similar drug resistant genes. Inactivation of lincosamide by drug modification was observed in 11 of 12 strains.

Amis, Jacqueline E. Sigma Phi, Guilford College. Characterization of *Listeria monocytogenes* -containing phagosomes in dendritic cells

Listeria monocytogenes is a Gram-positive bacterium and the causative agent of the disease Listeriosis. Listeriosis is a highly invasive infection and has the highest case-fatality rate of any food borne illness (38%). This infection is particularly difficult for the immune system to combat because *L. monocytogenes* is one of the few pathogens that can escape from the phagosome of its host, replicate in the cytosol and move from cell to cell without entering the extracellular environment. Since *L. monocytogenes* avoids the humoral immune system, the trafficking of *L. monocytogenes* in dendritic cells (DCs) is

critical to initiating the anti-*L. monocytogenes* immune response. This pathway is uncharacterized in DCs and is most likely different than in macrophages because DCs are optimized for antigen presentation rather than bacterial destruction. In this study, we characterized the phagosomes containing *L. monocytogenes* in bone-marrow derived DCs using confocal microscopy. It was found that *L. monocytogenes* does not co-localize with Lamp-1, a lysosomal marker, and only partially localizes with Lysotracker, an acidotrophic fluorescent dye. This suggests that *L. monocytogenes* may be in an early or late endosome rather than a phagolysome. To confirm this, we will examine the early and late endosomal markers Rab5 and Rab7, respectively.

Miller, W. Ryan. Lema Tomé, CM. Beta rho chapter. Wake Forest University. MK801-induced Caspase-3 in the Postnatal Brain: Inverse Relationship With Calcium Binding Proteins.

Age-dependent, neuronal apoptosis following N-methyl-D-aspartate receptor blockade has been linked to loss of calcium. We examined expression of activated caspase-3, as well as the calcium binding proteins, calbindin-D 28K, calretinin and parvalbumin, following injection of vehicle or the N-methyl-D-aspartate receptor blocker, MK801, in postnatal day 7 or 21 rats. At postnatal day 7, MK801-induced activated caspase-3 expression was frequently found in mutually exclusive cell populations to those expressing any of the three calcium binding proteins. For example, in the somatosensory cortex, most immunoreactivity for activated caspase-3 was found in layers IV/V, layered between areas of high calbindin or calretinin expression. Suggesting expression patterns of these proteins were inversely related, these same brain regions no longer displayed MK801-induced activated caspase-3 at postnatal day 21, but instead robustly expressed calcium binding proteins. This later surge in expression was true for parvalbumin in regions such as the retrosplenial cortex. Calbindin-D 28K was also found to increase in the same regions though not as impressively as parvalbumin. Developmental regulation of calcium binding protein expression may be a critical factor in age-dependent sensitivity to agents that disrupt calcium homeostasis in maturing neurons, providing a possible mechanistic explanation for age-dependent MK801 toxicity.

Babcock, Sharon, Beta Rho, Wake Forest University. Oral self-administration of nicotine in the honey bee.

When given the choice between sucrose solution with nicotine or without nicotine, it was found that one-day-old honey bees will ingest nicotine sucrose solution. One-day-old bees were placed in Plexiglas cages, which held two microcentrifuge tubes with differing food solution, and were kept in a dark incubator at 37°C for 24 hours. After, the tubes were weighed to determine amount of fluid ingested by the total number of bees alive. A preference for the 50% sucrose solution was determined, although the bees consistently drank from the nicotine tube. Next, the solutions were flavored with peppermint oil to rule out any adverse taste effects of the nicotine, but no change was observed. Different concentrations of nicotine were tested with no correlation to the amount of liquid ingested. Finally, the bees were given a choice between 50% sucrose solution and plain water with nicotine to test if the bees were drinking the nicotine solutions for the added physical effects. The results showed a consistent volume of water and nicotine solution to be consumed each day. Therefore, it can be concluded that the honey bee will orally self administers nicotine for the drug's physical effects.

Hett, Carol W. & Dr. Steven Brewer. Sigma Sigma. University of North Carolina Wilmington. Structure and diversity of tree species of Bluethenthal wildflower preserve.

Mesic forests of the southeastern coastal plain are poorly understood. Yet as suburbanization of the coastal plain continues, representatives of mesic forest types are

likely to persist primarily as small, protected areas for public use. Therefore, it is becoming important to understand these mesic forests in order to conserve and/or enhance their native biological diversity. This project describes one such remnant mesic forest – the ten-acre Bluethenthal Wildflower Preserve – located on the campus of the University of North Carolina Wilmington. Methods included the use of the North Carolina Vegetation Survey protocol to sample two 0.1 ha plots in order to describe the physical structure and the composition and diversity of trees species in the preserve. The data revealed that Plot 1 and Plot 2 contained 13 and 11 species of adult trees respectively, yet both contained 18 species of tree seedlings. Plot 1 stems totaled 251 adults, 341 saplings and 4816 seedlings while Plot 2 totaled 285 adults, 335 saplings and 5877 seedlings. Spatial dispersion was clumped for most species. Preliminary predictions about the population dynamics of these species suggest that the forest is changing. Data analysis showed high levels of recruitment for most species except those that require fire. Gap phase dynamics likely plays a significant role.

Saunders, Cheston & Ann Stapleton. Sigma Sigma, University of North Carolina Wilmington. Experimental Design in Molecular Genetics.

The stationary characteristics of modern land plants aided in the creation of sophisticated adaptations to changing environmental conditions. We know much about plant adaptations and responses in visible light, but very little about responses to Ultraviolet light. The decline of the stratospheric ozone layer, due to human activity, increases our interest in the effects of UV radiation on plants. Exposure to UV radiation places plants under oxidative stress which results in an increase in the amount of oxygen radicals. In response to oxidative stress, plants have evolved protective adaptations such as catalase. Catalase is an enzyme which breaks down hydrogen peroxide, a harmful oxygen radical. Biochemical assays are one of the most effective means to measure enzyme activity; however, they can be difficult to design and implement. Most research concerning catalase activity centers on animal tissue cultures, thus requiring the design modifications of the manufacturer's directions.

Pennington, Britney. Sigma Psi, Florida Institute of Technology—The regulation of mitogen activated protein kinase phosphorylation during starfish oocyte maturation and fertilization.

Mitogen-activated protein kinase (MAPK) plays an integral role in oocyte maturation and fertilization in several animals. The enzyme is active when phosphorylated and inactive when dephosphorylated. Using the starfish *Asterina miniata* as a model system, regulation of MAPK was studied during oocyte maturation and fertilization. This organism was chosen as a model because MAPK has not previously been studied in this animal, and it is possible to obtain unlimited number of cells synchronized in first meiosis. Immature oocytes were collected from starfish ovaries and were treated with the maturation hormone 1-methyladenine (1-MA). Addition of 1-MA stimulated MAPK phosphorylation in oocyte populations, which was detected by phosphorylation-state specific antibodies. The rise in free calcium at fertilization is thought to inhibit MAPK's phosphorylation cascade, and this experiment showed that MAPK is dephosphorylated in a time-dependent manner after the addition of sperm. These experiments demonstrate that 1-MA stimulates an increase in phosphorylated MAPK while fertilization leads to its dephosphorylation. MAPK significantly influences the cell cycle and may be involved in cancer mechanism. This experiment found that *A. miniata* provides an appropriate model for investigating MAPK regulation which relates the cell's meiotic and mitotic processes. NIH AREA Award R15 HD048712-01 supported this research.

Wales, Erica. Sigma Psi, Florida Institute of Technology. Alligator (*Alligator mississippiensis*) predation on non-native fish species.

The American alligator (*Alligator mississippiensis*), once threatened with extinction, has rebounded to large numbers in Florida and elsewhere. This apex predator in southern freshwater ecosystems is therefore a valuable tool for understanding ecosystem dynamics. A previous study indicated that alligators are opportunistic feeders, and showed that 55% of their diet consisted of fish (Delany et al., 1999). The objective of the current study was to determine whether increasing populations of non-native fish species in the St. John's River basin affect alligator diet, and whether dietary change might indicate ecosystem change. Gut contents of nine alligators were analyzed to determine diet; special attention was given to the relative content of native vs. non-native fish prey. Alligator gut contents consisted of 90% fish; 83% of this was composed of non-native species (primarily South American armored catfish, *Hoplosternum* sp., and plecostomus, *Hypostomus* sp.). These results suggest that alligator diets change over time and/or with respect to location/population. More importantly, this work shows that non-native invasive species can be important components of the overall alligator diet. The apparent alligator dietary shifts suggest that massive ecological change is occurring in freshwater.

Cirilo, Stephanie and Justin Horne. Sigma Gamma, Erskine College. Salmonella spp. in Small Pets: Prevalence and Characterization of Isolates

Previous studies and articles from the *Greenville News* have reported a disturbing occurrence of pathogenic bacteria such as salmonella being found in small mammalian pets. There have been several reported illnesses and at least three deaths due to exposure to these "pocket pets." Until recently, reptiles had been considered the main pet reservoirs for infectious salmonella. In this study, we asked two main questions related to this problem: 1) Do we see salmonella more often in birds and reptiles than in mammals? and 2) Are any of the collected strains showing marked drug resistance? We tested 31 reptiles, 4 birds, and 26 mammals using methods from Ebani et. al. (2005). Salmonella colonies were then tested for antibiotic resistance. We found differential rates of the presence of salmonella and antibiotic resistance between mammals and reptiles. No salmonella was found in birds. 61% of the reptiles and 39% of the mammals were positive for salmonella. Of the isolated organisms, none showed antibiotic resistance. For future research we plan to vary and expand our sample base as well as control for age of the test subjects.

Kanapeckas, Kimberly L. Sigma Gamma, Erskine College. Use of the bacterial two-hybrid system to detect protein-protein interactions necessary for carboxysome assembly.

Many autotrophic bacteria maximize their CO₂ fixation potential by sequestering ribulose-1,5-bisphosphate carboxylase/oxygenase (RuBisCO) inside inclusion bodies called carboxysomes. The carboxysome of *Halothiobacillus neapolitanus* is composed of at least eight different polypeptides, two of which are the large and small subunits of RuBisCO. Other identified polypeptides include the shell subunits CsoS1A, CsoS1B, CsoS1C, CsoS2A, CsoS2B, and CsoS3. The genes that encode RuBisCO (*cbbL* and *cbbS*) and the shell peptides (*csoS2*, *csoS3*, *csoS1C*, *csoS1A*, and *csoS1B*) along with two unidentified open reading frames (ORFA and ORFB) constitute a carboxysome operon. Previously, the yeast dihybrid system was utilized to determine which proteins encoded by this operon interact during carboxysome formation. Stratagene's BacterioMatch™ bacterial two-hybrid system is being implemented at present to further verify protein-protein interactions. Each carboxysome gene was inserted in-frame into the BacterioMatch vectors and transformed into *E. coli*. Self-activation assays indicated that none of the proteins tested independently activate transcription of the reporter genes. Various constructs have been transformed into *E. coli* in pairwise combinations. Interactions have not been indicated thus far; however, our positive control exhibited fewer interaction-indicative colonies than expected.

McMahan, Caleb D. Sigma Gamma. Erskine College. Geographic Variation in the Morphology of *Hemidactylus bowringii* (Reptilia: Squamata: Gekkonidae) in Myanmar and Yunnan, China.

The Southeast Asian country of Myanmar (formerly Burma) has five currently recognized species of geckos within the genus *Hemidactylus*. *Hemidactylus* are united by derived traits in toe morphology of the manus and pes, with sizeable variation among species in other traits. These variations make *Hemidactylus* a systematically difficult group. A recent molecular study shows genetic divergences within the tropical Asian clade, consisting of two monophyletic groups (Carranza & Arnold, 2006). The purpose of this project was to conduct a systematic study of one Burmese species, *H. bowringii*, to determine if morphological differentiation has occurred alongside the genetic divergences. Mensural and meristic characters were adapted from Zug et al., 2003. Data were collected from samples from throughout Myanmar and Yunnan, China and analyzed using Systat 11. Results show significant ($P < 0.05$) differences between the two *H. bowringii* clades. Additionally, morphological differentiation occurs throughout other regions in Myanmar, with potentially more divergences within this species than represented in the phylogeny.

Oakes, Robyn, Dr. Jennifer Cruse-Sanders and Dr. Nita Eskew. Beta Alpha, Salem College. The effect of pesticides on ginsenoside content in *Panax quinquefolius*.

American ginseng (*Panax quinquefolius*) is a medicinal herb found naturally in the eastern United States and Canada. As a result of habitat change and the practice of harvesting plants from natural populations wild American ginseng has become uncommon, and its population status is regulated and monitored by the U.S. and Canadian federal governments. To meet consumer demands, an increasing amount of ginseng for production comes from large farms, some of which use pesticides in cultivation. As an herbal remedy, ginseng is not regulated in the same manner as FDA approved drugs, so there is a concern for potential pesticide exposure to humans through use of ginseng products. In this study, pesticide analysis using Gas Chromatography- Mass Spectrometry was performed on commercially available ginseng products, as well as three wild populations of ginseng leaves harvested in western North Carolina and Virginia. Furthermore, the wild populations were analyzed for their concentrations of two biologically active ginsenosides, Rb1 and Rg1, using High Performance Liquid Chromatography. This research is the first part of an ongoing project to determine how the presence of pesticides affects ginsenoside concentration.

Clark, Amanda. Psi, Winthrop University. A novel method and cell line for investigating endothelial microtubule formation in vitro.

Angiogenesis is the growth of new blood vessels. One method used to investigate angiogenesis is the MatrigelTM microtubule formation assay, which allows endothelial cells (EC) to form blood vessel networks. Although MatrigelTM has been an excellent tool for qualitative studies of angiogenesis, no reliable quantitative method to calculate the number of microtubules formed exists and only one EC line, HUVEC, is currently used for these studies. We established a quantitative method for determining the microtubule density of HUVECs and a second EC line, EAhy129. After incubation of the EC in MatrigelTM, five photos per well were taken using an inverted light microscope. Stereology was used to determine the surface area covered by microtubules. The photos were overlaid with a 4800-pixel grid (Image J). The mean number of hits, points where one of the grid's vertices crossed a microtubule, for each of the views per well was determined and divided by the number of vertices per well to give the surface area of each well covered by microtubules. This stereological method, using HUVEC or EAhy129, of determining microtubule formation is more quantitative and reproducible than other methods.

Christopher Bennett. Psi, Winthrop University. Development of a Hypoxic Bio-Reactor for a Cardiac Tissue Culture Model.

During Myocardial Infarctions (MI), ischemia causes cell death (apoptosis/necrosis) through hypoxia and acidosis. The cellular responses to this are not well understood and few *in vitro* cardiac tissue models exist. This study uses a 3-D cardiac tissue culture system as an *in vitro* model of MI-induced ischemia. To accomplish this, a closed-circuit Hypoxic Bio-Reactor (H-BR) that continuously monitors pH /dO₂ was constructed. To initially test the response of the Seeded Cardiac Tubes (SCTs) to hypoxic injury, we exposed them in the H-BR to different oxygen levels (atmospheric-21%, physiological-6%, and hypoxic-1.5%) for at least 14-hours and measured myocyte death by Troponin-I release. To look for changes in gene expression RNA from the SCTs was isolated. To determine if the *in vitro* response mimics the *in vivo*, RNA is being used in Real Time-PCR to test for gene expression levels of TNF- α , HIF- α , IL-1 β , and IL-6, compared to the STO-fibroblast cell line.

Graves, Christian. Psi, Winthrop University. Development of a Non-Radioactive Prostate Cancer Adhesion Assay and the Utilization of Calcein Acetoxymethyl Ester in the Analysis of Thrombomodulin.

The progression of prostate cancer (CaP), the second most common cancer type in males, increases when tumor cells lose their cell-cell adhesion properties, invade surrounding tissues, and metastasize. CaP cells then regain cell adhesion properties for extravasation. This research investigates how an anti-coagulant receptor, thrombomodulin (TM), that is increased in CaP regulates CaP metastasis. Radioisotopic labeling has been utilized with such isotopes as Chromium fifty one (Cr) to detect cellular adhesion. Because radioactive methods introduce safety concerns and produce results with high variability due to washing and sample transfer issues, we have developed a non-radioactive model to investigate cell-cell adhesion in three CaP and two endothelial cell lines. Calcein AM is a polar fluorescent molecule that is internalized across the cell membrane that produces less background fluorescence following wash steps as opposed to Cr. In addition, transfer from 96-well plates to vials for detection in a scintillation counter is unnecessary due to the use of a 96-well fluorescent plate reader. DU-145 and PC3 CaP cells were plated (primary layer) and labeled with five μ M/mL Calcein AM (secondary layer). Utilizing Calcein AM with a fluorescent plate reader provides comprehensive data on the percent adherence between CaP and endothelial cells.

Jones, Kristin D. AND Dr. Jennifer Cruse-Sanders. Beta Alpha, Salem College. The teaching collections of Emma Lehman held at Salem College Herbarium (SC).

The Salem College Herbarium (SC) maintains some of the earliest collections to be housed in North Carolina. Scholar and professor Emma Lehman was instrumental to the development of this herbarium. Her late 19th century collections spanned from Winston-Salem, North Carolina to destinations all over Europe. This study looks at the breadth of her teaching collection to identify the classification system that was in use and the specimens collected. The system of classification used by Lehman in her collection was compared to systems that were in use during the late 1800s and to later evolutionary and phylogenetic systems. This study also explores the history of *Monotropsis lehmaniae* Burnham (now *Monotropsis odorata* Schwein. ex Ell.) discovered by and named for Emma Lehman.

Ellison, Nicole. Tau Xi, Meredith College. Hematocrit Buffy Coat: Volume.

A hematocrit is the percent of red blood cells (RBC's) in a given volume of blood. The buffy coat, which appears as a white layer on top of the RBC's in the hematocrit tube,

consists primarily of white blood cells (WBC's). Most of the research regarding the buffy coat has been on perfecting the removal of the buffy coat from the RBC's (Shimizu, 1984; Knutson, 1999); not on changes in the buffy coat. The purpose of this research was to determine changes in the volume of the buffy coat. Variables included time and temperature. Standardized heparinized and non-heparinized blood capillary tubes and centrifugation procedures were used to test for hematocrits (Allen and Harper, 2006). The size of the buffy coat was measured at time 0 and at 3 hour intervals for up to 48 hours with the use of a microscope micrometer. Hematocrit capillary tubes were held at 10°C, 22°C, and 37°C. The volume of the buffy coat was observed to increase during 0 to 48 hours by 29.82% for heparinized tubes and 7.67% for non-heparinized tubes. Increased volume was most rapid at 37°C. Heparinized tubes demonstrated less buffy coat volume. Cellular changes within the buffy coat need to be evaluated in order to determine the possible cause of the increased volume with time.

DeSimone, Sarah. Beta Eta, Florida Southern Unniversity. Effects of Soil Type on Three Varieties of Wisconsin Fast Plants, *Brassica rapa*.

Abstract. Wisconsin fast plants, *Brassica rapa*, are a staple in laboratory experiments because of its short growing time and the precise genetic makeup that negates a number of variables in certain ecological experiments. Optimum performance of fast plants requires precise conditions such as a rich soil type, constant water availability, and intense florescent light. The purpose of this research was to test the growth rates and seed production of the standard, the rosette dwarf, and the yellow-green varieties of fast plant in three different types of soil compositions. Variables tested were leaf production, flower production and seed production over a period of six weeks. The soil compositions were distinguished by water holding capacity and texture. The three types of soils tested were a standard potting soil, building sand, and native Central Florida soil. There were five replicates of each plant variety in each of the soil types. The results showed potting soil had the best water holding capacity, the native soil was second and the building sand was worst. The results also showed that all three varieties grew best in potting soil, second best in native Central Florida soil and worst in building sand.

Kanter, Lauren. Beta Eta, Florida Southern College. Bioassay on water quality using the Least Killifish and Hydrilla.

The purpose of this experiment was to test the water quality and its effects on the Least Killifish and Hydrilla. Least Killifish (*Heterandria Formosa*) is a tough little fish that has been used widely in many research programs. They can grow to a size of 1.5 inches. In this experiment, four ten gallon aquarium tanks were used: two for lake water and two for tap water. Nine to ten fish were used in each of the tanks and 76 grams of Hydrilla were added to each tank. Ammonia, pH, Nitrate, and Phosphate were recorded each week along with a fish count for each week as well. The fish in each tank were fed once or twice a week. Each week had increasing amounts of food .1, .2, and the final figure being .3 grams. The fish weight and the growth of aquatic plants were measured in the two different water conditions. The length of this experiment was 7 weeks. The results in water quality showed that there was no detectable nitrate in the water, phosphate was relatively constant and ammonia was constant, and pH fluctuated from week to week. The fish gained weight over the 7 weeks in both treatments.

***John C. Johnson Poster Award Winner Southeastern District I**

Poster Presentations Southeastern District II

Bowman, Contessa B. Mu Omicron, Columbus State University. The effectiveness of prophylactic eye drops on the reversal of UV light induced cataracts.

Cataracts are a cloudiness of the lens within the eye which obstructs vision and are found to develop in many species including rats, dogs, and humans. Vision is hindered where this "cloudiness", made of water build up and broken crystalline, takes form. Usually, concentrating itself in the lens of the eye. Oculvet is an eye medication containing carnosine as its active ingredient. The manufacturer indicates in its documentation that topical application is an effective treatment for the prevention cataracts and for removal of pre-existing cataracts. For this experiment rats were anesthetized and exposed to UV radiation in both the UVB and UVC ranges. Three groups of rats had cumulative exposures of 92 hours, 147 hours, and 221 hours. After the completion of the UV treatment each experimental rat was treated with one drop Clear Eyes® brand eye drops mixed to 1% for carnosine in the left eye. The right eye was treated with eye drops without carnosine. After six weeks of daily treatment the rats were sacrificed and both eyes removed. Extent of damage to the corneas and lenses of the treated and untreated eyes were compared.

Dollar II, Edgar J. Mu Omicron, Columbus State University. Historic distribution of canebrakes in Louisiana.

Arundinaria gigantea, also known as cane, is a native bamboo of the southern United States. Cane often grows in large single-species stands known as canebrakes that are typically found in low, swampy areas, usually near rivers. Canebrakes were a prominent feature of the early American landscape, and historical reports describe large canebrakes across the Southeast, especially in Louisiana. However, few large canebrakes exist today, and they are now regarded as a critically endangered ecosystem. In order to determine the extent and location of historic canebrakes in Louisiana, I used land survey plat maps from the 1820's to 1850's created by the General Land Office. I examined every plat map for Louisiana, to determine which had canebrakes. These plat maps were then georeferenced using the GIS program ArcMap to generate a statewide map showing where historic canebrakes were present. My results indicate that there were 45,542 hectares (112,489 acres) of canebrake in the state during this time period (0.3 % of the state). Canebrakes were most common in the northeast portion of Louisiana and near the Mississippi River.

Carney, Jodie. Mu Upsilon, University of Tennessee at Martin. Development of methods for detection of cellulolytic bacteria in the digestive system of Yellow-bellied Sapsuckers (*Sphyrapicus varius*).

Yellow-bellied Sapsuckers forage on trees by consuming phloem tissue which contains cellulose. Our long-term goal is to determine whether Yellow-bellied Sapsuckers have symbiotic bacteria capable of breaking down cellulose. The specific goal of this project is to develop an improved medium for screening bacteria for cellulolytic activity, specifically β -1,4-endoglucanase production. We developed three hybrid medias based on M9 minimal salts and Pettersson medium using caboxymethyl cellulose as the carbon source. These hybrid medias were tested with the following positive control species: *Pseudomonas cellulosa*, *Clavibacter michiganensis* sub. *sepedonicus* strains As-1 and OFF, *Bacillus circulans*, and *Agrobacterium tumefaciens*. The agar plates were stained with Congo Red dye to visualize the zone of clearing from the hydrolysis of the β -1,4-glucan bonds. Preliminary results indicate that the hybrid medias allow for better growth of

cellulolytic organisms along with providing a larger, more defined zone of clearing. Further research is needed to confirm these results before we apply these findings to the Yellow-bellied Sapsucker.

Jude A. Miller, Virginia L. McFarland, & Ann D. Gathers. Mu Upsilon, The University of Tennessee at Martin. Designing a comprehensive survey of pre and post-operational effects of medium frequency Russian stimulation versus other rehabilitation practices within the meniscal allograft transplant population.

Meniscal allograft transplantation, a relatively recent surgical procedure, involves grafting of a cadaver meniscus into the patient's knee to restore knee function and to prevent joint degeneration. Pre and post rehabilitation practices influence the successfulness of meniscal transplants. Our research goal is to determine the effect of Russian stimulation on muscle girth and muscle strength and to determine overall patient satisfaction as compared to other rehabilitation protocols. The construction of a comprehensive rehabilitation survey is critical when collecting data. Literature indicates that existing rehabilitation surveys neglect several important factors. After a critical review of these surveys, we designed an assessment tool that addresses the following weaknesses: subjective versus objective data, demographics, selection criteria, and longitudinal pre and post-operative conditions. This survey was developed as a research tool with the goal of impacting therapeutic rehabilitation of meniscal allograft patients and other patients with debilitating musculoskeletal problems.

Barnes, Jennifer. Mu Epsilon, Troy University. Wastewater impacts on yeast: analysis of the *Saccharomyces* Genome Deletion library in response to effluent from the Troy Waste Water Treatment Facility.

A unique research tool exist for researchers using *Saccharomyces cerevisiae*—the *Saccharomyces* Genome Deletion Strains. In this collection of 4700 individual yeast strains, each individual member of the collection harbors one unique gene deletion. The deletion strains are being utilized to assess the impact of effluent water from the Troy Wastewater Treatment Plant on the growth of various yeast strains as compared to distilled water and water upstream (untreated) of the treatment plant. Preliminary investigations to determine the feasibility of propagating the deletion strains in the wastewater were completed. Twelve strains were selected from the deletion library to monitor growth in media containing the various water samples and the growth of the yeast assessed by daily monitoring of the growth. After this preliminary data collection, all strains will be characterized to identify those that display hypersensitivity (reduced growth) or hyposensitivity (enhanced growth) when the water from the Troy Waste Water Treatment Plant is compared to untreated water. This research may help elucidate important metabolic pathways that are activated by exposure to the materials in treated (or untreated) water.

McHugh, Robert. Mu Epsilon, Troy University. Assessing transcription termination levels in replication deficient strains of *Saccharomyces cerevisiae*.

To determine linkages between DNA replication and transcription termination, yeast strains Mcm1 and Mcm10-1—replication deficient temperature sensitive strains—were examined to determine the capacity for transcription termination by RNA polymerase II. Transcription termination reporter constructs were introduced into the replication deficient strains and the resulting termination activity examined at permissive, non-permissive, and semi-permissive temperatures. Qualitative and quantitative assessments were performed, and the results indicate a decrease in the level of transcription termination at the semi-permissive temperature in one mutant strains (Mcm1). Therefore, the failures in replication in replication deficient mutant strains impact the capacity for transcription and transcription termination providing evidence for a link between transcription termination and replication.

*Burwinkel, Karen E. Mu Iota, Northern Kentucky University. Cytochrome P4501A1 and arsenic in benzo(a)pyrene-induced carcinogenesis.

The environmental pollutants arsenic and benzo(a)pyrene (BaP) are well-known human carcinogens commonly found together in substances such as cigarette smoke. Arsenic is usually addressed as a non-mutagenic co-carcinogen, with the potential to enhance the effects of mutagens such as BaP, although the mechanisms remain unclear. BaP exerts its carcinogenic effects by forming DNA adducts, leading to DNA replication errors and mutations. The detoxification of BaP in the liver is a multi-step process requiring several enzymes, notably cytochrome P4501A1 (CYP1A1). Furthermore BaP is a potent inducer of transcription of the CYP1A1 gene. Interestingly, depending upon the pathway of action by CYP1A1, BaP may undergo chemical activation into its ultimate carcinogenic metabolite, benzo[a]pyrene-7,8-dihydrodiol-9,10-epoxide (BPDE). In this study we examined the impact of arsenic on CYP1A1 activity, utilizing zebrafish (*Danio rerio*) as a model species. Co-exposure of arsenic and BaP led to significant decreases in CYP1A1 activity when compared to BaP alone. The effect is likely transcriptional, as levels of CYP1A1 transcript decrease as a result of exposure to both arsenic and BaP. The impact of arsenic on CYP1A1 activity may alter cellular levels of BPDE, thus potentially influencing BaP-induced carcinogenesis.

Sheffield, Daniel. Mu Epsilon, Troy University. Impact of wastewater effluent on the growth, morphology, and gene expression of *Saccharomyces cerevisiae*.

Effluent from the Troy Waste Water Treatment Plant (WWTP) in Troy, Alabama was analyzed to determine the impacts of exposure on the growth of *Saccharomyces cerevisiae*. Wastewater is treated to the secondary level at the WWTP and the treated water is returned to a site in Walnut Creek that has been classified as moderately impacted. To analyze the impacts of the wastewater on the viability and growth of a simple biological system, three water samples were collected or obtained: Troy WWTP effluent water (Walnut Creek downstream site), non-effluent water (Walnut Creek upstream site), and distilled water. Rich growth medium—YPD containing yeast extract, peptone, dextrose—was prepared with identical chemical and nutrient components but using each individual water type. Wild type cells were inoculated onto the three media types in both solid and liquid culture. Growth was assessed both quantitatively and qualitatively and differences in colony and microscopic morphology were observed. Subtle effects on growth were noted, but drastic differences were not observed. This analysis facilitates continuing analysis of induction of gene expression in response to exposure to wastewater treatment effluent.

Gehner, Jessie R. Mu Iota, Northern Kentucky University. Reduction of *Escherichia coli* in Compost by Actinomycetes Enrichment.

Composting is an invaluable method of improving soil quality for agriculture and an environmentally friendly method of organic waste disposal. Composting produces humus, a substance that is structurally beneficial and nutritionally available to plants. Composting reduces the number of pathogens in the waste via heat from microbial metabolism. However, some pathogens are evolving to withstand this heat. Microbial competition also reduces pathogens. Actinomycetes are sources of antibiotic compounds and because of that can out-compete other bacteria. Actinomycetes species can withstand the hottest temperatures generated in compost and are able to digest some of the hardest to degrade compounds and thus are essential players in the creation of humus. This study was designed to examine if the addition of Actinomycetes will reduce *Escherichia coli* in compost. *E.coli* is not only a pathogen, it also is an indicator of the presence of other pathogenic bacteria. Results indicate that addition of Actinomycetes reduced *E. coli* in compost. These results are qualitative, and further studies aim to produce quantitative data, as well as determine which strains of Actinomycetes are most effective. This study

reveals the potential of using Actinomycetes as a compost additive to produce high quality, low-pathogen compost for use in agriculture.

Brua, Brittany. Mu Chi, Midway College. Determination of toxicity of cucurbitacin against *Caenorhabditis elegans*.

Parasite resistance is becoming more of a threat in the equine industry and other methods of parasite control must be researched. Cucurbitacin is a compound found in pumpkins and squash, it is a known anthelmintic and was used by Canadian pioneers to rid animals and humans from parasites. *Caenorhabditis elegans* is a free-living nematode heavily used in the scientific community for research. In this study, four trials were completed testing cucurbitacin against *C. elegans* for toxicity. Four concentrations were tested, 16.6%, 9.0%, 4.8%, and 2.4%, and two controls ran for every trial. The nematodes were counted at 72 hours and 6 days. The overall study average for nematodes counted at 72 hours at 16.6% concentration was 8 and the control average for the study at 72 hours was 1012. This supports the possibility that cucurbitacin could be used in the future as an anthelmintic for horses.

Feinauer, Rachel L. Mu Iota, Northern Kentucky University. The establishment and succession of phytoplankton and zooplankton in Loch Norse, the Northern Kentucky University campus lake.

This study investigated the establishment and succession of phytoplankton and zooplankton in the newly constructed Northern Kentucky University campus lake, Loch Norse. The lake has a disparate foundation, with one side a mud basin and the other lined completely by concrete. The plankton from each side of the lake were sampled from October 2005 through February 2007. The abundance of the phytoplankton and zooplankton were calculated for each sample. It was found that the establishment of these microorganisms to the lake was quick, with calculable abundance within the first week of the addition of water to the lake. The results also showed that zooplankton and phytoplankton populations are affected by external, climate changes such as rainfall and ambient temperature, surrounding watershed, and the addition of chemical dye. The change in the abundance of these microorganisms over time, were internally affected by predation as is seen in "top-down control."

Wallach, Jennifer, Greg Scull, Chris Steed & Josh Turner. Sigma Epsilon Jacksonville State University. Aquatic animal biodiversity within the Talladega National Forest.

The Alabama Department of Conservation and Natural Resources Comprehensive Wildlife Strategy participates in the monitoring of many endemic animal species. Many aquatic species of concern inhabit the Shoal Creek District of Talladega National Forest. Some species that are of high conservation concern include fish, muscels and crayfish. Specifically, *Cyrinella caerulea* (blue shiner), *Etheostoma brevirostrum* (holiday darter), *Etheostoma ditrema* (coldwater darter), the crayfish species *Cambarua scotti* (Chattooga river crayfish), and the mussel species *Lampsilis altilis* (the finelined pocketbook). Studies have been conducted on species diversity and recently a larger project focused on documenting genetic diversity has commenced. In this study collected data is reported for *Cyprinella trichroistia* and *Cyprinella callistia* (tricolor and Alabama shiners, respectively). These samples were collected from geographically separated areas in the Shoal Creek District of Talladega National Forest. For analysis, total proteins were extracted from muscle, gill, and liver tissues. Samples were run on IEF gels and stained for isozyme analysis. LDH, MDH, and IDH isozyme patterns indicate diversity both within and among the species. Upon completion of isozyme analysis, mitochondrial 12S DNA analysis will be conducted. Eventually, genetic diversity indices (e.g., Nei's genetic identity, or *J*) will be used to establish overall heterozygosity of the populations.

Guinn, Neeley N. Pi Delta, East Tennessee State University. Isolation and Characterization of Insulin Signaling Genes Involved in Diapause in the flesh fly *Sarcophaga crassipalpis*.

Diapause is a programmed developmental arrest that allows insects to survive in harsh environmental conditions. There is a possible link between diapause state and the insulin signaling pathway. Insulin signaling has been associated with many physiological processes including aging. A working hypothesis is that the diapause and aging programs have a common set of gene expression pathways via insulin signaling. The expression of flesh fly (*Sarcophaga crassipalpis*) genes involved in diapause has been analyzed by using a heterologous microarray in an ongoing study. Using bioinformatics resources, the amino acid and nucleotide sequences for 7200 *Drosophila* genes were used to support and analyze similar gene sequences using BLASTP. The BLASTP results were aligned using CLUSTAL W to identify conserved regions of each gene. Once a conserved area was located, primer was designed for the gene sequence. Messenger RNA (mRNA) from *S. crassipalpis* was isolated in a time-course experiment during seven stages of non-diapausing pupae. The designed primer was tested and gene expression verification was done using reverse transcriptase/polymerase chain reaction (RT-PCR). PCR products were analyzed by agarose gel electrophoresis to determine the size and relative concentration of gene products. Gene products were not isolated and the primer did not work for the non-diapausing RNA. Further investigation will include RNA isolation from diapausing pupae and testing using the same methods.

Truesdell, Suzanne D. Mu Iota, Northern Kentucky University. Comparison of ecophysiological properties of Amur honeysuckle (*Lonicera maackii*) and eastern redcedar (*Juniperus virginiana*) throughout the year.

This study compares ecophysiological relationships of Amur honeysuckle (*Lonicera maackii*) and eastern redcedar (*Juniperus virginiana*) to determine if their differences provide a competitive advantage for their colonization. *L. maackii* is an invasive species that is widespread throughout the eastern United States and has negatively affected natural habitats. *J. virginiana* is a native conifer found in similar areas. A comparison of these species' water and carbon relations could provide an understanding of *L. maackii*'s success as an invasive species. Chlorophyll fluorescence, photosynthesis, CO₂ concentration, and water potentials have been measured biweekly in five *L. maackii* and *J. virginiana* individuals since May 2006 at a road cut site on the Northern Kentucky University campus. Sap flow, rainfall, relative humidity, ground moisture, temperature, and light intensity are being measured. Preliminary results show higher photosynthetic rates in *J. virginiana* higher photosynthetic yield in the summer for *J. virginiana*, and water potential in spring and summer was less negative in *J. virginiana*. Stomatal conductance, transpiration, photosynthesis, and water potential increased during summer until late July, when drought caused a decline in both species. *J. virginiana* appears to be better adapted to this site. Assuming drought conditions become more common, *J. virginiana* may out-compete *L. maackii*.

***John C. Johnson Poster Award Winner Southeastern District II**

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Publication Date: March 31, 2007



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CALL FOR NOMINATIONS

Editor of *Chinquapin*

The Newsletter for the Southern Appalachian Botanical Society

The Southern Appalachian Botanical Society (SABS) is seeking nominations (including self-nominations) for the position of editor of the society's quarterly newsletter, *Chinquapin*. *Chinquapin* provides members with news of plants in the east, society news, book reviews, and other topical information of interest to people in the SABS, and to people who are interested in plants in general. We wish an editor who can generate both a hard copy for mailing and an online version for our website (www.newberry.net.com/SABS). The editor also becomes a member of the Executive Council of the SABS.

Qualifications include membership in SABS and a background in plant research, with a minimum of at least a Master's degree in the botanical sciences, or, equivalent experience working with plants for a number of years. Successful candidates should also have extensive word processing skills, including WORD and/or WordPerfect, and good organizational and communication skills. Knowledge of Microsoft Publisher is also desirable, but not required.

Nominations may be sent via email or regular mail to:

Dr. Howard S. Neufeld, President, SABS
Department of Biology
572 Rivers St.
Appalachian State University
Boone, NC 28608
Email: neufeldhs@appstate.edu

Tel: 828-262-2683

Nominations should be received by March 31, 2007, but the position will remain open until filled. For further information on the position, please contact Dr. Howard Neufeld.

SPECIAL REQUEST FROM THE TREASURER

As many of you know, ASB has had a few tough years financially, prior to our very successful meeting in Gatlinburg. Our challenge to raise funds in the face of rising costs is a problem we should be able to solve. All contributions are much needed and are appreciated tremendously. Some ASB members give faithfully every year, and some even give two or more times in a year!

Most of our dues payments go to printing and mailing of the ASB Bulletin, *Southeastern Biology*. Most of our meeting revenue is spent on meeting expenses. So, your contributions are very important to the life and future of ASB. ASB could not operate and could not hope for a bright future without your understanding of our needs and your generous gifts throughout the year.

Send contributions to Tim Atkinson, Carolina Biological Supply Company, 2700 York Road, Burlington, NC 27215-3398.

Contributions to ASB, a not-for-profit organization exempt under Internal Revenue Code Section 501(c)(3), are tax deductible. We welcome any inquiries you may have.

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ATTENTION STUDENT MEMBERS

After each annual meeting of the Association, the Local Arrangements Committee summarizes the arranging process and reports this information on to the host(s) for the next meeting. The report also records the successes, mistakes, and recommendations for changes. Recognizing that student members may have thoughts on how the meeting might be improved, the chair of the Local Arrangements Committee for the 68th annual meeting in Columbia, SC, has appointed Pam Brannock to help with this process. Pam is a graduate student at USC, and she is an enthusiastic student member of ASB who worked many hours in registration and at the ASB booth. Her role in our post-meeting analysis is to receive meeting improvement suggestions from the student membership.

Please take time soon to send her your suggestions by e-mail, brannockp@biol.sc.edu or by snail mail, Department of Biological Sciences, University of South Carolina, Columbia, SC 29208. Be assured, your suggestions will be passed forward.

œ

AVAILABLE POSITIONS IN THE SOUTHEAST

Position: Lecturer

Institution: University of North Carolina at Charlotte

Location: North Carolina

Description: University of North Carolina Charlotte, BIOLOGY (2 positions).

FULL-TIME LECTURER. The University of North Carolina at Charlotte is seeking applicants for a 12-month, permanent, non-tenure track lecturer position in Biology. Required qualifications: Masters Degree in Biology and teaching experience at the college or university level. Desired qualifications: Ph.D. degree in Biology. The lecturer will teach a 2-semester introductory course for biology majors stressing evolution as a unifying theme. The lecturer will also be responsible for training and supervision of laboratory teaching assistants. Teaching experience in freshman biology at a 4-year institution is highly desirable. Applicants are expected to develop and implement innovative teaching strategies, including use of technology for both lectures and labs. See <http://www.bioweb.uncc.edu/resources/positions.htm>, for additional information.

Please send C.V., three letters of reference, and a statement of teaching philosophy to Freshman Lecturer Search Committee, Dept. of Biology, UNC Charlotte, 9201 University City Blvd., Charlotte, NC 28223. Review of applications will begin December 6, 2006 and continue until the position is filled.

FULL-TIME LECTURER. The University of North Carolina at Charlotte is seeking applicants for a 12-month, permanent, non-tenure track lecturer position in Biology. Required qualifications: Masters Degree in Biology and teaching experience at the college or university level. Desired qualifications: Ph.D. degree in Biology. The lecturer will direct a new program for an Interdisciplinary Minor in Biotechnology, teach courses in the biotechnology area, act as a regional liaison for the biotechnology program, and advise biology majors.

Please send C.V., three letters of reference, and a statement (3-page maximum) of your teaching experience and ability to contribute to the biotechnology program to Biotechnology Lecturer Search Committee, Dept. of Biology, UNC Charlotte, 9201 University City Blvd., Charlotte, NC 28223. Review of applications will begin December 6, 2006 and continue until the position is filled.

The lecturer position will begin at the start of the fiscal year, July, 2007. UNC Charlotte strives to create an academic climate in which the dignity of all individuals is respected and maintained. Therefore, we celebrate diversity that includes, but is not limited to ability/disability, age, culture, ethnicity, gender, language, race, religion, sexual orientation, and socio-economic status. AA/EOE.

Position: Invertebrate Biology

Institution: George Mason University

Location: Virginia

Description:

The Department of Environmental Science and Policy (ESP) of George Mason University invites applications for a full-time, tenure-track Assistant Professor position in invertebrate biology for August 2007. We seek an individual with a professional focus that complements current ESP faculty working in conservation biology and aquatic ecology. Experience with field-based or

conservation genetic research is a plus. The successful candidate will be expected to pursue a vigorous externally-funded research program, aspire to teaching excellence, collaborate with current faculty, and participate in our interdisciplinary graduate programs. Teaching duties will include undergraduate courses in animal biology, invertebrate biology and a graduate course in the applicant's area of expertise. A Ph.D. is required. George Mason University is a large, public university in Northern Virginia. ESP collaborates in BS and BA degrees in Biology, and offers MS and Ph.D. degrees in Environmental Science and Policy. Our faculty includes ecologists, biologists, geologists, oceanographers and policy specialists. We have a strong history of research in both aquatic ecology and conservation biology and are planning a new satellite campus and field center at Belmont Bay on the tidal Potomac River adjacent to the Occoquan Bay National Wildlife Refuge (30 minutes from Fairfax) with diverse habitats ranging from open water and wetlands to upland meadows. For additional information see <http://mason.gmu.edu/~espp> (department) and <http://www.gmu.edu>.

Candidates should complete the online application for position F5252z at <http://jobs.gmu.edu> and submit CV, letter of intent including statements of research and teaching interests, examples of published work, teaching evaluations (if available), and contact information (with e-mail addresses) of three references to: Dr. Andrea Weeks, I Search Committee Chair, Dept. of Environmental Sciences and Policy, Mail Stop 5F2, George Mason University, Fairfax, VA 22030-4444. Review of applications will begin on 11 December 2006. George Mason University is an Affirmative Action, Equal Opportunity Employer. We strongly encourage women and minority candidates to apply.

Position: Assistant Professor of Biology

Institution: Francis Marion University

Location: South Carolina

Description:

Francis Marion University Florence, South Carolina. For complete job description, visit: www.fmarion.edu/about/hr. Two Available Positions in Biology.

Assistant Professor of Biology - Position No. 07-28. (Tenure-track). Ph.D. required. Teaching responsibilities include upper-level Human Anatomy and Physiology courses as well as introductory biology courses for majors and non-majors. Ability to teach Microbiology would be helpful. Academic advising, committee work, and involvement in scholarship and professional activities will be expected.

Assistant Professor of Biology - Position No. 07-27. Non Tenure-Track. (One-year appointment, renewable for up to three years). Teaching responsibilities include courses in introductory biology for biology majors as well as Environmental Biology and Human Biology for non-majors. Other responsibilities include advising students, service to the community, and scholarly activity. Minimum qualifications: Ph.D. in the biological sciences strongly preferred; A.B.D's will be considered.

An Affirmative Action, Equal Opportunity Institution.

Position: Assistant Professors
Institution: Mississippi State University
Location: Mississippi
Description:

The Department of Biological Sciences at Mississippi State University (www.msstate.edu/dept/biosciences) invites applications for Assistant Professor tenure-track positions that begin August 16, 2007. These faculty members will contribute to one of three focus areas: Cell Biology/Genetics, Ecology/Evolution or Microbiology/Immunology. The scientific infrastructure at Mississippi State University includes focus areas in proteomics, genomics and digital biology, along with these supporting facilities: the Life Sciences & Biotechnology Institute (www.mafes.msstate.edu/biotech), the Electron Microscope Center (www.msstate.edu/dept/emc) and the GeoResources Institute (www.gri.msstate.edu). Successful candidates will develop externally funded research programs in any of the above-mentioned areas, direct graduate students and contribute to the teaching mission of the department. Minimum requirements include a Ph.D. in a related biological sciences field, but all-but-dissertation candidates will be considered.

To apply, send CV, reprints of three representative publications, a concise statement of current and future research interests (1 page), and identify the position/area you are applying for plus relevant areas of teaching competence. Applicants should also arrange for at least three letters of reference to be submitted on their behalf. Screening will begin January 15, 2007 and will continue until the positions are filled. Send applications (hard copy) to Dr. Nancy Reichert, Interim Head, Department of Biological Sciences, P.O. Box GY, Mississippi State University, Mississippi State, MS 39762. (FacultySearch@biology.msstate.edu).

Mississippi State University is An Affirmative Action/Equal Opportunity Employer.

Position: Taxonomic Botanist
Institution: Austin Peay State University
Location: Tennessee
Description:

Nominations and applications are invited for a full-time, 9-month, tenure-track position of Assistant Professor-Taxonomic Botanist to begin August 2007. Salary is competitive and commensurate with academic preparation and experience. Duties and responsibilities include, but are not limited to the following: teach undergraduate and graduate courses from among the areas of i.e. Introductory Biology (majors and non-majors), Botanical Diversity, Plant Taxonomy, and Field Botany; serve as curator for the APSU Herbarium; and develop an externally funded Masters-level research program involving students.

Required Qualifications: A Ph.D. in botany, botanical ecology, or plant taxonomy is required, and college teaching experience is preferred. Candidate must have a record of scholarly achievement. Experience in the use of innovative, inquiry-based methods of instruction and current molecular research techniques is beneficial. Teaching assignments may involve travel to regional sites and/or distance learning venues. Experience with the taxonomy, ecology and distribution of southeastern flora is required.

Application Procedure: Please submit letter of interest, curriculum vitae, graduate and undergraduate transcripts, statement of research interests and teaching philosophy, and three letters of recommendation to: Office of Human Resources, Austin Peay State University, Attn: HR Faculty Applications, Department of Biology, PO Box 4507, Clarksville, TN 37044. Email: FacultyApplications@apsu.edu. Fax: (931) 221-7105.

For questions pertaining to this position you may contact Dr. Don Dailey, Chair, Department of Biology at daileyd@apsu.edu or phone 931-221-7781

Review of applications will continue until position is filled.

Minorities, women and members of other protected groups are encouraged to apply. Austin Peay State University is an Affirmative Action/Equal Opportunity Employer.

Position: Organismal Biology

Institution: Belmont University

Location: Tennessee

Description:

Belmont University invites applications for a tenure-track position beginning August 2007. Candidates must have earned a Ph.D. in an area of Organismal Biology, with expertise in Population Genetics desired. Candidates should expect to complete Ph.D. requirements by June 1, 2007. Preference will be given to applicants who can demonstrate excellence in teaching and the potential to maintain a strong undergraduate research program. Potential to contribute to the interdisciplinary Environmental Studies program is considered a plus. Normal duties include undergraduate instruction to majors and non-majors, advising, leading students in undergraduate research projects, and department and university responsibilities. As all Belmont undergraduates complete an innovative general education program with significant interdisciplinary components, Belmont University is particularly seeking applicants who can demonstrate the interest and ability to work collaboratively in course design and to teach interdisciplinary and topical courses in this program.

All applicants must complete an online application at www.belmont.edu/hr. While completing the application, applicants will be prompted to submit a letter of application, curriculum vitae, statement of teaching philosophy, explanation of research interests and samples of scholarly work, and a response to Belmont's mission, vision, and values statements. Three letters of reference and all transcripts must be mailed via postal service to: Dr. Robert Grammer, Chair, Department of Biology, Belmont University, 1900 Belmont Blvd., Nashville, TN 37212-3757. Screening of applications will begin January 15, 2007 and continue until the position is filled.

A comprehensive, coeducational university located in Nashville, TN, Belmont is a student-centered, teaching university focusing on academic excellence. The university is dedicated to providing students from diverse backgrounds an academically challenging education in a Christian community. Belmont is an EOE/AA employer under all applicable civil rights laws. Women and minorities are encouraged to apply.

Application Information. Contact: Dr. Robert Grammer, Department of Biology, Belmont University, Online App. Form: <http://www.belmont.edu/hr/>.

Position: Assistant Professor

Institution: EAST GEORGIA COLLEGE

Location: Georgia

Description:

RESPONSIBILITIES: Full-time faculty at East Georgia College teach 15-16 semester credit hours on and/or off campus, day and/or evening. Teaching duties may include courses at off-campus sites as needed. In addition to teaching, faculty are responsible for professional development, service to the institution, and participation in instructional assessment. Participation in college and community activities required.

QUALIFICATIONS: Doctorate preferred. Masters degree with a minimum of eighteen graduate semester credit hours of subject specific work in the field required. Candidates should be committed to the two-year college mission, with a primary interest in the teaching/learning process as related to the two-year college student. The successful candidate for the mathematics position must have a strong interest in teaching developmental mathematics and working with under-prepared students. Competence in electronic communications, as well as distance learning, is desired.

RANKS AND SALARIES: Dependent on qualifications and experience. Ten month contract; summer teaching possible.

APPLICATION DEADLINE: Applicant screening will begin on January 15, 2007.

STARTING DATE: Appointments to begin August 1, 2007, pending approval of funding.

THE INSTITUTION: East Georgia College is located in rural southeast Georgia. Swainsboro and Emanuel County, home of East Georgia College, have a population of 23,000 people. The community provides the benefits of small town living including friendly neighbors, low taxes, excellent recreation and a high quality of life. East Georgia College serves approximately 1,800 students and provides studies leading to the Associate in Arts and the Associate in Applied Science degrees. In addition to the main campus located in Swainsboro, the College also serves off-campus sites, the largest of which is located in Statesboro, GA.

APPLICATION PROCEDURE: Submit a letter of application; curriculum vitae; copies of college transcripts; a teaching philosophy statement; and names and contact information for three references to: Dr. Tim Goodman, Office of Academic Affairs, East Georgia College, 131 College Circle, Swainsboro, Georgia 30401

East Georgia College is An Equal Opportunity, Affirmative Action Institution. Federal law requires documentation of identity and eligibility for employment in the United States. Individuals who need reasonable accommodations in order to participate in the application process should notify Human Resources. Georgia is an Open Records State. East Georgia College, a two-year college of the University System of Georgia, is fully accredited by the Commission on Colleges of the Southern Association of Colleges and Schools, 1865 Southern Lane, Decatur, GA 30033-4097; phone (404) 679-4501.

Position: Assistant and Associate Professors of Biology

Institution: Tuskegee University

Location: Alabama

Description: TUSKEGEE UNIVERSITY, FACULTY POSITIONS IN BIOLOGY

The Department of Biology at Tuskegee University, producer of many outstanding researchers and medical professionals, is embarking upon a new direction in science education and research developing models for training students in integrative biology using multifaceted approaches. To assist us in this exciting new endeavor, we invite applications from individuals who are bold in their thinking and have a strong desire to collaborate with us in transforming the Biology Department to a world-class program.

We are seeking applications for tenure-track assistant professor or associate professor positions beginning Fall 2007. The successful candidates will have a Ph.D. in a biological discipline that integrates research aspects in one or more of the following areas: Genetics, Cell Biology, Molecular Biology, Neurobiology, Biochemistry, Microbiology or Physiology. Additionally, the candidate will be expected to establish an independent research program that provides training opportunities at both the undergraduate and graduate level, specifically in our M.S. degree program and the newly established Integrative BioSciences Ph.D. program. We especially seek candidates whose research interests are in the area of gene regulation as they relate to the areas listed. Tuskegee University has a strong commitment to the training of underrepresented groups and seeks candidates who are desirous to use their expertise to participate in this mission in an academically diverse environment. Primary teaching responsibilities will include undergraduate courses in introductory biology and advanced undergraduate and graduate courses in the area of specialization. It is expected that the candidates for these positions will have experience in utilizing inter-and multidisciplinary approaches for teaching and research and will utilize this expertise in both the department's M.S. program and the Integrative BioSciences Ph.D. program.

Applicants should submit curriculum vitae, concise statements of teaching philosophy and research goals, three letters of recommendation, and official transcripts to: Dr. John P. Davidson, Search Committee Chair, Department of Biology, Tuskegee University, Tuskegee, AL 36088. Application deadline is February 15, 2007. Tuskegee University is an equal opportunity employer and encourages applications from women and under-represented groups. For more information about the University, go to the Web page: www.tuskegee.edu.

Position: Biology

Institution: University of North Alabama

Location: Alabama

Description:

The University of North Alabama invites applications for faculty positions for the 2007-2008 academic year. Applicants are expected to demonstrate a strong commitment to teaching, research, service, and student advisement. Salary and rank will be based on qualifications of the successful candidate. Screening will begin immediately and will continue until positions are filled. The University of North Alabama is a comprehensive regional state university offering undergraduate and graduate degrees. The University has an enrollment of approximately 7,000 students. For additional information about the university,

visit our Web site at www.una.edu/. Teach human anatomy and physiology, animal physiology, and introductory biology courses.

Submit letter of application, résumé, copies of unofficial transcripts, and names, addresses, and telephone numbers of three current references to department chair, c/o Office of Human Resources and Affirmative Action, University of North Alabama, UNA Box 5043, Florence, Alabama 35632-0001. UNA is an equal opportunity employer committed to achieving excellence and strength through diversity. UNA seeks a wide range of applicants for these positions so that one of our core values, ethnic and cultural diversity, will be affirmed.

Position: Biology

Institution: Lenoir-Rhyne College

Location: North Carolina

Description: Assistant Professor of Biology, Lenoir-Rhyne College, North Carolina

POSITION AVAILABLE. Assistant Professor of Biology, School of Natural Sciences. Nine-month tenure track position.

BEGINNING DATE. Fall 2007

APPLICATION DEADLINE. Review of credentials will begin immediately and continue until the position is filled.

SALARY. Competitive and commensurate with academic qualifications and professional experience. Generous fringe benefits.

RESPONSIBILITIES. The normal teaching load is 21-24 hours in the academic year. The successful candidate will be expected to teach a wide variety of classes and labs in undergraduate biology, advise biology majors, participate in committee work, and contribute to course and curricular development in the discipline.

QUALIFICATIONS AND EXPERIENCE. Ph.D. in Biology, Zoology or related field required. The most desirable candidate will also have specialization in developmental biology (both classical and molecular), with an interest in vertebrate zoology and Human Anatomy & Physiology as well as teaching experience, and the ability to guide undergraduate research. Lenoir-Rhyne encourages applications from individuals with multicultural backgrounds.

CONTACT. Interested candidates should review the following site <http://www.lrc.edu/facultysearch2007/> Complete applications must be submitted electronically through the above Web site. Required information includes Web-based application form, Letter of application addressing position fit with the description above. List of three references with complete contact information, including e-mail and phone, Curriculum vitae, List of all undergraduate and graduate courses in biology and related fields along with grades and institution.

Position: Greenhouse Manager

Institution: East Carolina University

Location: North Carolina

Description:

Position # 34208; Department BIOLOGY, DEPT OF; Division Academic Affairs
Job Title RESEARCH SPECIALIST – JOURNEY; Working Title GREENHOUSE MGR/PLANT RESEARCH SPECIALIST; Number of Vacancies 1; Pay Grade Salary Grade Equivalent: 70; Salary Range \$33,650 - \$73,534.

Job Description: Principal responsibilities of this position include (1) maintaining an academic greenhouse and plants for teaching and research in controlled environments and (2) assisting with plant and ecological research in controlled environments and at research natural areas. Primary responsibilities involve numerous tasks associated with the implementation and management of a large diversity of plants in culture and for various research projects, including ordering and budgets. The selected candidate will support research in plant and ecological research from conceptualization to data collection, analysis, interpretation, and presentation. Duties of this position include serving as an expert resource in the standard techniques of plant maintenance and propagation in culture; developing a botanical collection for teaching and demonstration; and providing leadership, guidance, and support to students and volunteers. The selected candidate will participate in educational programs within and outside the area of responsibility by providing assistance with tours, participating in symposia/other events, and providing horticulture information to the public. The selected candidate will also perform other duties as assigned by the supervisor.

Candidates should possess demonstrated knowledge of plant research involving academic greenhouse material and management; demonstrated knowledge of all aspects of plant research (including design, execution, data collection, and analysis) and the ability to communicate this knowledge of research to professions and the public; and experience in training and supervision. Prefer degree/experience with major emphasis in plant science/horticulture and one year of directly related experience.

The selected candidate will be required to perform duties in the greenhouse and outdoors under variable weather conditions. Candidates must be able to lift heavy plants and loads. Candidates should possess a valid NC driver's license and be eligible to operate a state-owned vehicle in accordance with the ECU property policy. A public pesticide applicator's license is preferred.

Minimum Qualifications: Graduation from an accredited four-year college/university and one year of directly related experience; or an equivalent combination of training and/or related experience.

Special Instructions to Applicants

SCREENING: Screening will begin February 12, 2007, and will continue until the position is filled.

APPLICATION 1) Please attach the following to your online application: Resume, Letter of application in which qualifications are addressed (to demonstrate written communication skills), List of two references (with email and phone contact information), Copies of transcripts or a list of related courses taken. 2) Two letters of reference should be forwarded to Dr. Claudia L. Jolls (jollsc@ecu.edu) or Department of Biology, East Carolina University, Greenville, NC 27858-4353.

*Applications without the requested attachments and/or reference letters will not be disqualified, but will be considered incomplete by the hiring department.

This position is subject to the Career Banding Salary Administration Plan. If candidates are not identified at the Journey level, management may consider candidates at a lower competency level. Pay will be commensurate with applicant's competencies as well as budget, equity, and market considerations.

Department Homepage www.ecu.edu/biology.

ECU Statement East Carolina University is an Equal Opportunity/Affirmative Action University that accommodates individuals with disabilities. Individuals requesting accommodation under the Americans with Disabilities Act (ADA) should contact the Department for Disability Support Services at (252) 737-1016 (Voice/TTY).

Proper documentation of identity and employability is required at the time of employment. Rank Level. Job Open Date 01-11-2007. Job Close Date Open Until Filled. Date Initial Screening Begins 2-12-2007. Job Category Staff – Professional. Full-time/Part-time Full-time. Applicant Pool All Applicants Required Applicant Documents. Application Types Accepted Application (SPA and CSS only).

Position: Molecular Geneticist

Institution: Thomas More College

Location: Kentucky

Description:

Position: Molecular Geneticist; Salary: Unspecified; Institution: Thomas More College; Location: Kentucky; Date posted: 1/17/2007; Thomas More College, located in Crestview Hills, KY in the Greater Cincinnati Area is a small, private Liberal Arts Catholic College with an enrollment of 1400+ students. The Department of Biology invites applicants to apply for a full-time one year visiting assistant professorship, with potential conversion to a tenure track position beginning August, 2007. Ph.D. required. Candidate's area of expertise should be in Molecular Genetics (or related area). Primary duties will involve teaching upper division undergraduate lecture/lab courses in Molecular Genetics and Introductory Genetics. In addition to teaching, the successful candidate will be expected to provide academic advising for biology majors, serve on college committees and develop research opportunities for undergraduate students. Successful candidates must provide evidence of quality teaching experience. For information about Thomas More College see our web site at: www.thomasmore.edu.

Send curriculum vitae, unofficial graduate and undergraduate transcripts, statement of teaching philosophy and research interest, and three letters of recommendation to Dr. Kathleen Barone, Search Committee Chair, Department of Biology, Thomas More College, 333 Thomas More Parkway, Crestview Hills, KY 41017.

Position: Biology

Institution: Lander University

Location: South Carolina

Description: Lander University has 2 positions available in the Department of Biology.

Position #1. Comparative Vertebrate Anatomy and Animal Development: Lander University, a public comprehensive university in the Upstate region of South Carolina, seeks qualified candidates with expertise in comparative vertebrate anatomy and animal development. Starting date for the position is August, 2007.

Required qualifications: Ph.D. in comparative vertebrate anatomy, evolutionary biology, or closely related field. A qualified candidate will have demonstrable expertise (based on graduate course work, research, publications,

or teaching experience) in comparative vertebrate anatomy and animal development; and ability to use computer technology to support teaching.

Responsibilities: Include teaching 300-level courses for the major in comparative vertebrate anatomy and animal development, a 200-level human anatomy course for nursing students, and 100-level general biology courses; maintaining a research program that involves undergraduates; academic advising; and providing service to the department, university, and community.

Excellent oral and written communication skills in English are expected. A letter of application should explicitly address the specific qualifications for this position. Review of applications will begin immediately and continue until the position is filled.

Send letter of application, curriculum vitae, statement of teaching philosophy, copies of graduate & undergraduate transcripts, and the name, address, e-mail address, and phone number of three references to: Comparative Anatomy Search, c/o Jamie Collier, Lander University, 320 Stanley Avenue, Greenwood, SC 29649. Application materials may also be sent via e-mail to jcollier@lander.edu. AA/EOE.

Position # 2, Microbiology and Immunology: Lander University, a public comprehensive university in the Upstate region of South Carolina, seeks qualified candidates with broad training in general microbiology and immunology for a tenure track assistant professor position. Starting date for the position is August, 2007.

Required qualifications: Ph.D. in microbiology or immunology, demonstrable expertise (based on graduate course work, research, publications, or teaching experience) in microbiology (including microbial ecology & metabolism) and immunology, and ability to use computer technology to support teaching. Responsibilities: Teaching 400-level courses for the major in general microbiology and immunology, a 200-level microbiology course for nursing students, as well as a 100-level general biology course; maintaining a research program that involves undergraduates; academic advising; and providing service to the department, university, and community.

Excellent oral and written communication skills in English are expected. A letter of application should explicitly address the specific qualifications for this position. Review of applications will begin immediately and continue until the position is filled.

Send letter of application, curriculum vitae, statement of teaching philosophy, copies of graduate & undergraduate transcripts, and the name, address, e-mail address, and phone number of three references to: Microbiology Search c/o Jamie Collier, Lander University, 320 Stanley Avenue, Greenwood, SC 29649. Application materials may also be sent via e-mail to jcollier@lander.edu AA/EOE.

Contact Information: E-mail : jcollier@lander.edu, Phone : 864-388-8386, Fax : 864-388-8130, Ms. Jamie Collier, Search coordinator, College of Science and Mathematics, Lander University, 320 Stanley Avenue, Greenwood, SC 29649, USA.

Position: Director: Marine Education

Institution: University of Southern Mississippi

Location: Mississippi

Description:

DIRECTOR JL SCOTT MARINE EDUCATION/ TENURE-TRACK FACULTY POSITION. The Department of Coastal Sciences, Gulf Coast Research Laboratory, The University of Southern Mississippi, invites applicants for a director/tenure-track faculty position at the ASSISTANT to FULL PROFESSOR level in MARINE SCIENCE EDUCATION. The position is approximately 50% as director of the JL SCOTT MARINE EDUCATION CENTER and 50% as member of the faculty of the department of coastal sciences. Anticipated start date is summer to fall 2007.

The successful candidate will hold an earned doctorate or equivalent, in a marine-related discipline and have demonstrated a strong scholarly interest in marine science education, research and outreach. As the director of the MARINE EDUCATION CENTER, the individual will provide leadership and direction for the USM-GCRL JL Scott Marine Education Center. As a tenure-track member of the faculty of the department of coastal sciences, the successful candidate will develop a strong educational research program that includes mentoring M.S. and Ph.D. graduate students and publishing in peer-reviewed outlets.

The director will foster a vision for marine education focusing on K-12 programs, pre-college teacher professional development programs and opportunities for mature, life-long learners. The incumbent must have a willingness to be part of the higher education community that supports development of science teacher education at the state and federal level. The director will be able to work creatively and effectively with students, faculty, staff and other educators. The candidate must be an excellent communicator and possess both verbal and written skills with the ability to speak publicly and give presentations.

The successful candidate will have a record or demonstrate exceptional promise of obtaining extramural funding. The successful candidate will be expected to maintain and expand the MEC's nationally-recognized, externally-funded research, education and outreach programs. The department of coastal sciences (www.usm.edu/gcrl) is located at the Gulf Coast Research Laboratory campus in Ocean Springs, Miss. Coastal sciences is a research-oriented department with academic emphases on graduate studies leading to the Doctor of Philosophy and Master of Science degrees.

Please send a letter describing research and teaching interests, along with a current vita, reprints (up to four) and the names and addresses of three references to: Ms. Kalin Lloyd, Department of Coastal Sciences, The University of Southern Mississippi, Gulf Coast Research Laboratory, 703 East Beach Blvd., Ocean Springs, MS 39564; tel: 228.872.4201; fax: 228.872.4204; e-mail: kalin.b.lloyd@usm.edu. Review of applications will begin December 15, 2006 and will continue until an appropriate candidate is found.

All applicants must complete an employment application form located on the University of Southern Mississippi Human Resources Web site at www.usm.edu/hr. AA/EOE/ADA.

Contact information: E-mail : kalin.b.lloyd@usm.edu, Phone : 228-872-4201, Fax : 228-872-4204, Ms. Kaline Lloyd, Department of Coastal Sciences,

University of Southern Mississippi, Gulf Coast Research Laboratory, 703 East Beach Blvd., Ocean Springs, MS 39564.

Position: Geology

Institution: Shorter College

Location: Georgia

Description: Shorter College, Assistant Professor of Physical Science, Geology, Geochemistry, Geophysics.

Earth/Physical Science position for 2007-2008 academic year. Ph.D. required (Geology, Geochemistry, Geophysics, etc.). Responsible for lecture and laboratory for introductory courses in Natural/Physical/Earth Science, as well as upper level Earth Sciences (i.e. Geology). Must have a strong desire to teach and advise undergraduates.

Candidates interested in the position must send CV, all transcripts, at least three professional references and statements of teaching and religious philosophy to Brenda Newman, Human Resources Manager, Shorter College, Box 2119, 315 Shorter Avenue, Rome, GA 30165. (Fax #: 706-236-1515).

Shorter College, located in Rome, GA is a Christian liberal arts college. The college is affiliated with the Georgia Southern Baptist Convention.

Position open until filled. Shorter College is an Equal Opportunity Employer.

Position: Human Anatomy & Physiology

Institution: UT Martin

Location: Tennessee

Description:

Department of Biological Sciences, Assistant Professor of Biological Sciences. Ph.D. in Biology or related field by August 1, 2007 with teaching experience in human anatomy and physiology. Preference may be given to applicants with an expertise in animal physiology or developmental biology. The successful applicant will teach courses in human anatomy and physiology and the freshman biology sequences. Other courses may be taught depending on expertise and departmental needs. Additional responsibilities include service and other scholarly activities normally associated with the Department and the University. Interested persons must submit a letter of application, a current vita, statement of teaching philosophy, copy of transcript for the terminal degree, and letters from at least three professional references who can address the applicant's ability as an instructor. Electronic applications will be accepted; however, letters of reference will not be accepted electronically. Before final consideration, the applicant's file must be complete.

Applications should be sent to: Dr. Ann Gathers, Committee Chair, Department of Biological Sciences, 249 Brehm Hall, The University of Tennessee at Martin, Martin, TN 38238. This is an extended search from a previous advertisement. The Search Committee will begin evaluating applications April 5th and will continue until a suitable candidate is identified.

The University of Tennessee at Martin is a primary campus in the University of Tennessee System. The campus is located in Northwest Tennessee approximately 125 miles north of Memphis and 150 miles west of Nashville. The University of Tennessee at Martin has a combined graduate and undergraduate enrollment of approximately 6,500 students. The emphasis is solidly on

excellence in undergraduate instruction. We seek candidates who demonstrate a similar commitment.

UT Martin is an EEO/AA/Title VI/Title IX/Section 504/ADA/ ADEA employer. The University seeks to diversify its work force. Therefore, all qualified applicants, regardless of race, color, national origin, religion, gender, age, disability or Vietnam veteran status, are strongly encouraged to apply. E-mail : agathers@utm.edu; Web Site: <http://www.utm.edu/departments/artsci/biology/index.htm>; Phone: 731-881-7178; Fax: 731-881-7187; Dr. Ann Gathers, Assistant Professor, Biological Sciences.

Position: Drug Discivery

Institution: SCYNEXIS Inc.

Location: North Carolina

Description: Protozoan Parasite Drug Discovery Research at SCYNEXIS Inc.

SCYNEXIS, Inc. is a dynamic company that delivers effective and innovative drug pipeline solutions to our pharmaceutical partners. We provide world-class research and development services in biological sciences, medicinal, analytical and process chemistry that range from hit discovery to clinical proof of concept.

We have an opening for a Research Associate to join our parasitic protozoa (African trypanosomes) drug discovery group. A BS or MS in Biology, Biochemistry, Cell Biology, Molecular Biology or a related field is required, with 1-5 years of industrial experience. The successful candidate will develop and execute biochemical and cell-based assays in a variety of different formats to support HTS and lead optimization projects as part of our growing infectious diseases franchise. Experience with liquid handling instruments and assay automation is also desirable. Prior research experience with protozoan parasites is not essential, but general tissue culture and drug target characterization expertise is needed. Close collaboration with other biologists, biochemists, medicinal chemists and external collaborators and partners, will be necessary for success. Strong teamwork, organizational skills, and written and oral communication skills are essential.

SCYNEXIS offers a competitive compensation and benefits program including a 401k with company match. Please email a cover letter, resume and references to ushuman.resources@scynexis.com or mail them to HR, SCYNEXIS, Inc., PO Box 12878, Research Triangle Park, NC 27709-2878. EOE. Contact: Bakela Nare Ph.D., Research Investigator, Parasitology, Scynexis, Inc., P.O. Box 12878, Research Triangle Park, NC 27709-2878, Phone: 919-206-7287, Fax: 919-544-8697.

Position: Co- Director

Institution: University of Louisiana

Location: Lafayette

Description: CO DIRECTOR, INSTITUTE FOR COASTAL ECOLOGY AND ENGINEERING (ICEE)

LOCATION: College of Sciences, University of Louisiana at Lafayette.

MAJOR RESPONSIBILITIES: 1) Coalesce the university's scientific and engineering expertise into a more cohesive and focused environment related to coastal ecology and engineering, 2) Assist federal and state agencies in development of policies, plans and projects, and 3) Grow the Institute's prominence and funding base while working in close concert with the ICEE

engineering co-director, centers, and researchers on this and other campuses. Secondly, the successful candidate will participate as a faculty member in either the Department of Biology, Geology, or Renewable Resources.

QUALIFICATIONS: Terminal degree and other qualifications to be appointed as a senior faculty member in the appropriate Department. Successful experience in securing funding for research related to coastal and ecological matters. Administrative experience and skills required.

SALARY: Commensurate with qualifications and experience.

ADMINISTRATIVE STRUCTURE: The Co-Director will report directly to the Vice President for Research and Graduate Studies. The Institute will be guided by an advisory committee composed of Vice Presidents and Deans.

APPLICATION: To apply send resume and a list of three references (include name, address, phone numbers, and email address) to Dean Bradd Clark, Chair of the Search Committee, P.O. Box 43290, Lafayette Louisiana 70504, (e-mail: deanclark@louisiana.edu). E-mail : deanclark@louisiana.edu. Phone : 337-482-6986, Fax : 337-482-1247, Dr. Bradd Clark, Dean, College of Science, University of Louisiana at Lafayette, P.O. Box 43290, Lafayette, LA 70504 USA.

Position: Biodiversity

Institution: Information International Associates, Inc.

Location: Oak Ridge, Tennessee

Description:

Content Knowledge Manager/Biodiversity Information Science. Information International Associates, Inc. (IIA), an information management, systems, & technology company, is seeking a FT Biodiversity Content Knowledge Manager / Scientist to work on biodiversity informatics projects in Oak Ridge TN.

Responsibilities: • Acquisition & development of electronic content. • Conducting inventories of information tools & standards used by biologists to manage information. • Building partnership relationships w/ other organizations to incl. govt., non-profit, conservation, and community groups. • Providing standardized information content on national plans, priorities, spatial & temporal information on the components of biological diversity. • Investigating new ways to retrieve & display relevant information content from disciplines outside the standard realm of biological information sciences.

Qualifications (Required): • A MLS degree w/ biology-related background or biology/fire-related MS degree with a background in information science, • 2-4 years experience pref., but will consider recent graduates w/ prior work exp. • Web design exp., incl. exp. w/ HTML, & familiarity w/ content mgnt systems • Exp. w/ databases & data mgnt tools.

Technical Background Desirable: • Exp. working in the scientific community, • Familiarity w/ Biodiversity / Biology / Ecology / Conservation Biology, • Familiarity w/ Fire Science / Fire Management, • Familiarity w/ metadata standards such as FGDC, DublinCore, Darwincore.

Qualified candidates please access our web site, www.iiaweb.com, complete all online application forms, and send electronically to: Martha Wallus, Dir. of Admin., E-mail: mwallus@iiaweb.com, IIA is an EEO/AA employer.

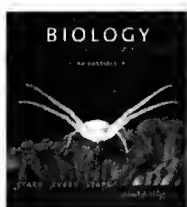
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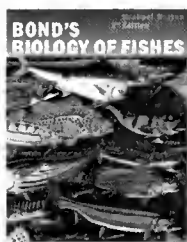


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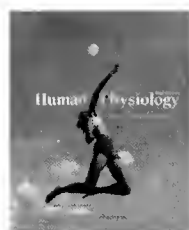
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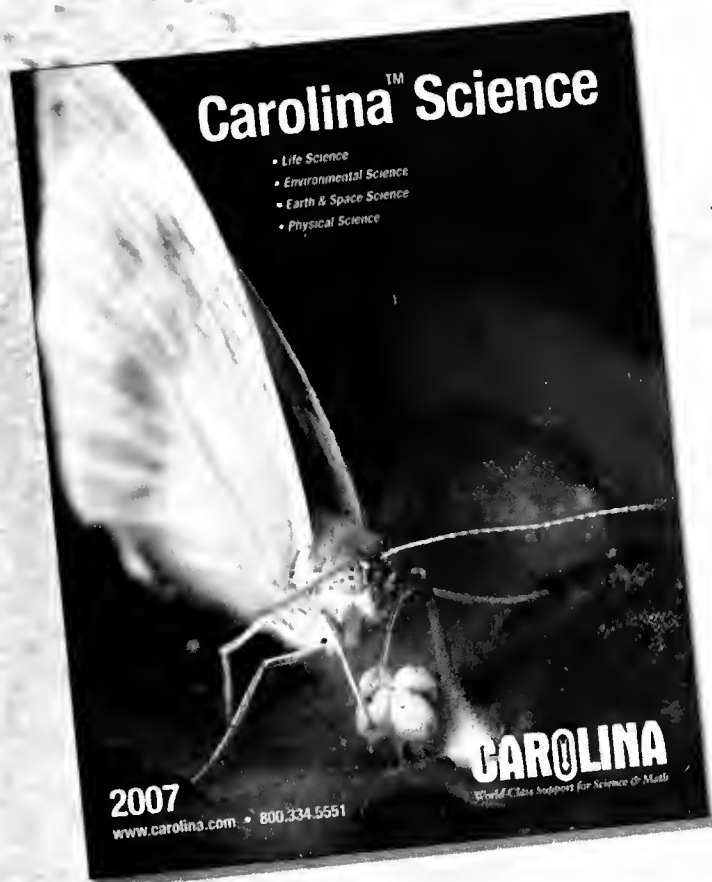
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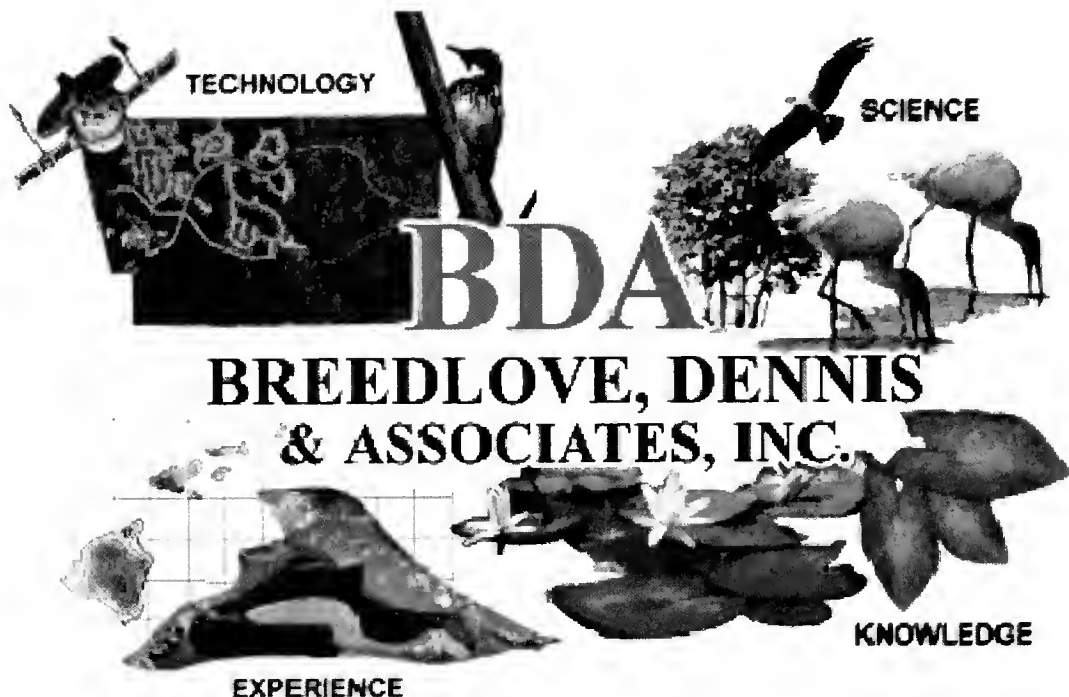
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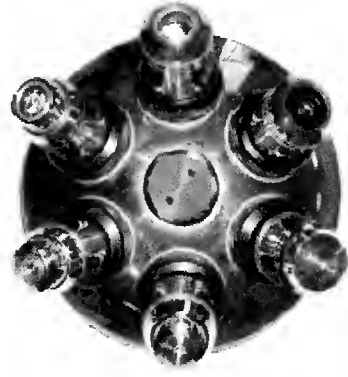
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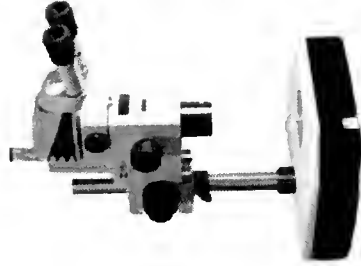


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